2014 OUTLOOK AND ANALYSIS LETTER

a report prepared for the

National Association of State Park Directors

By

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OVERVIEW

This year's *Outlook and Analysis Letter* updates and extends the analyses we completed in 2013. For the *2013 Outlook and Analysis Letter*, we measured the technical efficiencies of the states' park systems following a methodology designed for evaluating the effectiveness of government agencies in providing public services (Chambers 1988). This year, we repeat our production analyses with the updated data provided by the states' park systems for 2013. We also extend our analyses by estimating the effects of a federal climate change mitigation policy on the provision of outdoor recreation opportunities offered by the states' park systems. Many federal agencies, as well as the Office of the President, are actively pushing for regulations that both cap states' allowable emissions of greenhouse gasses and establish an open trading market (National Research Council 2011). These federal climate change mitigation policies will have variable impacts on individual states depending upon those states' emission levels and sources. Our analyses examine the likely consequences, experienced state-by-state, of a federal emission reductions policy. The findings are intended to inform the National Association of State Park Directors and individual state park system operators in planning for global environmental change and related federal policies.

The *2014 Outlook and Analysis Letter* begins, as usual, with an analysis and description of long-term and recent trends. We then move into our updated analyses of the state park systems' efficiency in providing outdoor recreation opportunities to the public. We conclude with our new analyses of the effects of a federal climate change mitigation policy on the provision of outdoor recreation opportunities offered by the states' park systems.

ABOUT THE AUTHORS

This year's *Outlook and Analysis Letter* signals a change in leadership for the research team contracted to manage and report on the AIX archive. Dr. Christos Siderelis had managed the AIX archive from 2006 to 2013 along with Dr. Yu-Fai Leung. Dr. Siderelis retired in the spring of 2013 and is now actively pursuing his passion of hiking in the desert southwest with his wife Kaye. Dr. Siderelis was instrumental in maintaining and reporting on data within the archive; for the past three years, he led the writing of the *Outlook and Analysis Letter.* This year the torch has been passed to Dr. Jordan Smith, who studied under Dr. Siderelis at NC State. Both Dr. Smith and Dr. Leung are indebted to Dr. Siderelis' tireless commitment to the use of rigorous empirical science to improve the outdoor recreation opportunities offered on public lands.

TRENDS AND FORECASTS

General Forecasting Methodology

For each of the key variables reported in this outlook and analyses—attendance, operating expenditures, capital expenditures, revenue, labor and acreage—we forecast point estimates ahead for three time steps (years). This is accomplished by fitting a time-trend regression model for the entire 30-year period represented by the data. In-sample (1984 – 2013) and out-of-sample (2014 – 2016) predictions are generated; these are simply the point estimates of the regression line for each year. Residuals are also calculated so that quantiles of forecast estimates can be generated.

Attendance – Trends

Attendance refers to the total counts of day and overnight visitation to both fee and non-fee areas (Leung et al. 2014). The long-term trends in attendance for all state park systems can be seen in Figure 1. Visitation to the states' parks systems has risen steadily since the beginning of our sampling period in 1984 when they received a total of 663 million visits. Attendance reached its peak in 2000, when the states' park systems received 787 million visits; it has since leveled off with annual attendance around 740 million. For 2013, attendance dropped from the 741 million visits seen in 2012 to 727 million visits, a 1.89% decline.

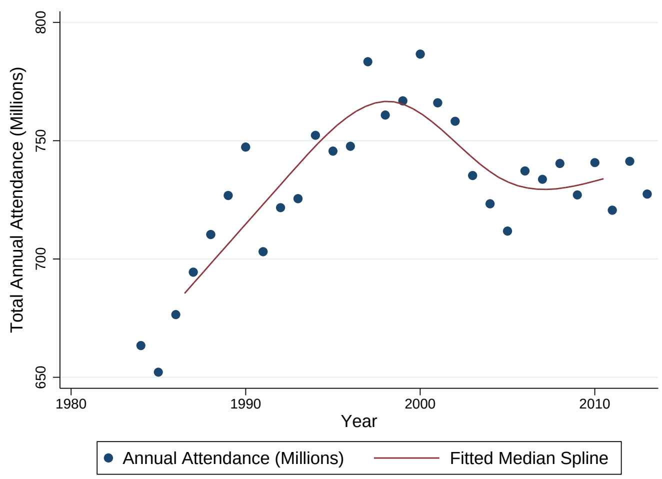

Figure 1. Total annual attendance to the 50 state park systems.

Attendance – Forecasts

Fitting our time-trend forecasting model to the attendance data suggest attendance will continue to gradually increase, as it has over the past 30 years (Figure 2). Our model predicts total annual attendance for 2014 to be 756 million; attendance is expected to increase to 757 million for 2015 and reach 759 million in 2016.

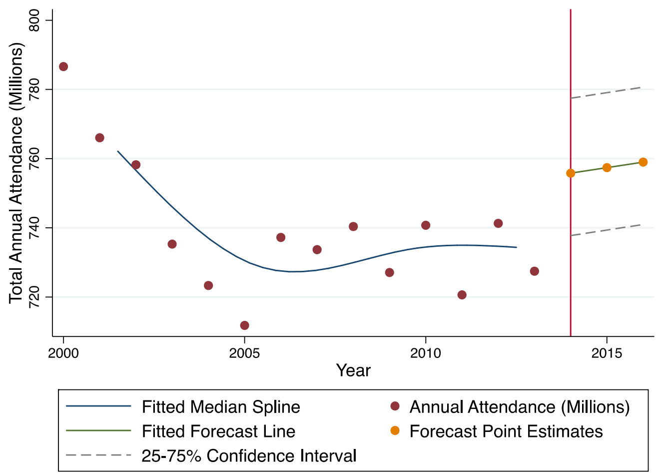

Figure 2. Forecasted annual attendance for the 50 state park systems.

Operating Expenditures – Trends

Operating expenditures are payments made for goods and services to manage a state park system (Leung et al. 2014). The long-term trends in operating expenditures across all of the states' park systems are illustrated in Figure 3. Operating expenditures have risen consistently over the past 30 years; they have increased by $59.7 million dollars annually, on average. For 2013 the states' park systems operating expenditures increased to $2.42 billion from the $2.36 billion reported in 2012; this is a 2.54% increase.

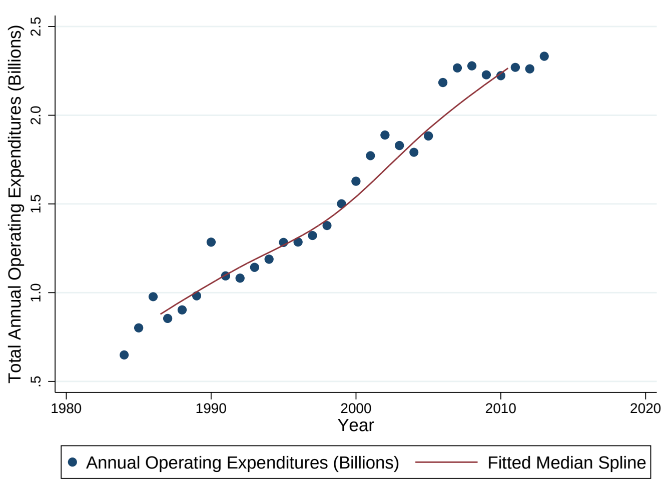

Figure 3. Total annual operating expenditures for the 50 state park systems.

Operating Expenditure – Forecasts

Our time-trend forecasting model suggests expenditures associated with providing the goods and services required to manage the states' park systems will continue to rise (Figure 4). Our model predicts total operating expenditures for 2014 to be $2.48 billion; this is expected to increase to $2.54 billion in 2015 and to $2.60 billion in 2016.

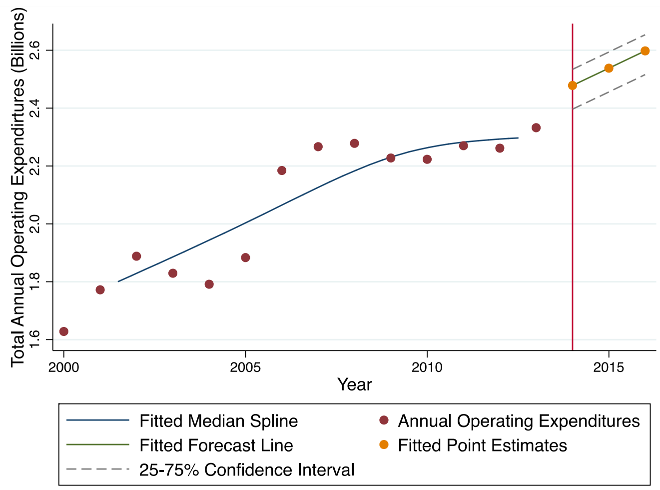

Figure 4. Forecasted operating expenditures for the 50 state park systems.

Capital Expenditures – Trends

Capital expenditures are non-recurring expenditures used to improve the productive capacity of a state park system (Leung et al. 2014). Typically, these are for land acquisition, periodic park improvements and construction. The long-term trend in capital expenditures is small as gradual increases have been observed over the past 30 years (Figure 5). Expenditures were exceptionally high in 2005, when state park system operators reported total costs of $1.38 billion. Capital expenditures have declined steadily since the 2008 recession, as would be expected given large-scale reductions in state appropriations, park-generated revenues and other funding sources tied to the health of the states' economies (Siderelis and Smith 2013). Capital expenditures were up in 2013 to $573 million, above the $488 million reported in 2012; a 17.4% increase.

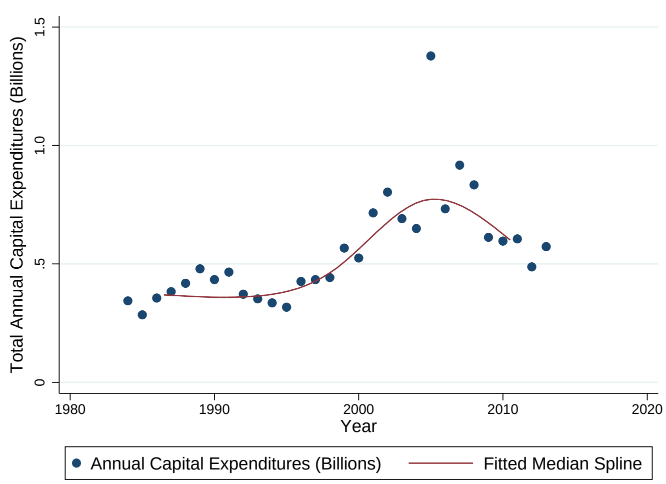

Figure 5. Total annual capital expenditures across the 50 state park systems.

Capital Expenditures – Forecast

Our time-trend forecasting model suggests, as expected given the long-term upward trend in operating expenditures, that capital outlays for improving the productive capacity of the states' park systems will continue to rise (Figure 6). The model predicts total capital expenditures to be $796 million in 2014, $812 million in 2015 and $828 million in 2016.

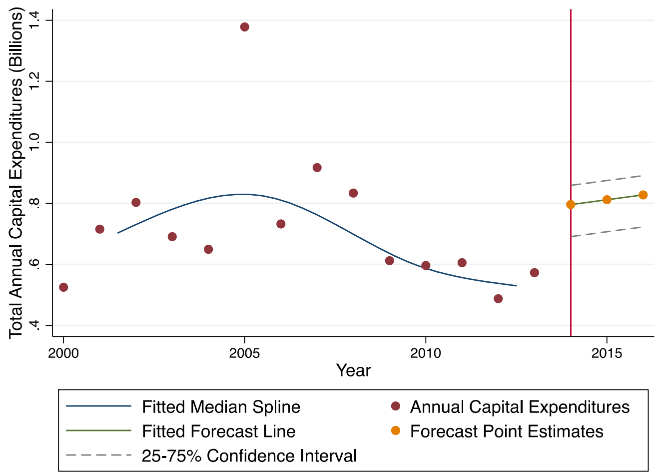

Figure 6. Forecasted annual expenditures across the 50 state park systems.

Revenue – Trends

Revenue is money generated from use fees and charges; it includes all revenue from 'entrance fees', 'camping fees', 'cabin/cottage rentals', 'lodge rentals', 'group facility rentals', 'restaurants', 'concessions', 'beaches/pools', 'golf courses', and 'other' sources such as donations (Leung et al. 2014). Revenue data within the AIX archive reveal steady year-over-year increases throughout the 30-year sampling frame (Figure 7). This past year (2013), total revenues were reported at $1.05 billion, up 0.96% from the previous year (2012).

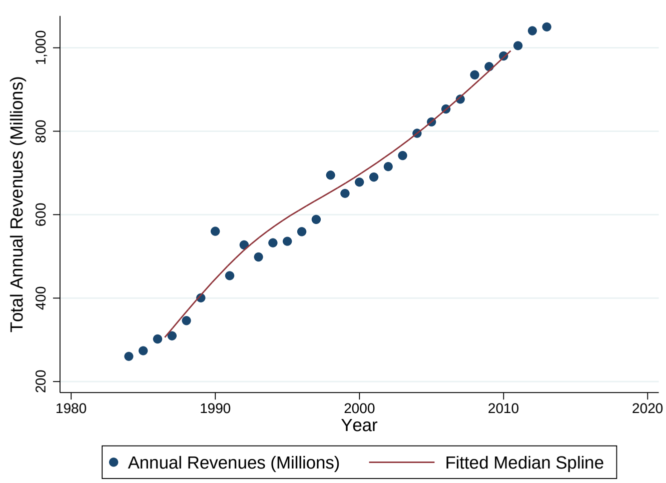

Figure 7. Total annual revenues generated by the 50 state park systems.

Revenue – Forecasts

Given the consistency of reporting in annual revenue data, we can be very confident in our forecasted values for the upcoming years (illustrated by the small confidence interval in Figure 8). Our model predicts total revenues generated across all state park systems will be $1.08 billion in 2014, $1.10 billion in 2015 and $1.13 billion in 2016; point estimates and the fitted forecast line is illustrated in Figure 8.

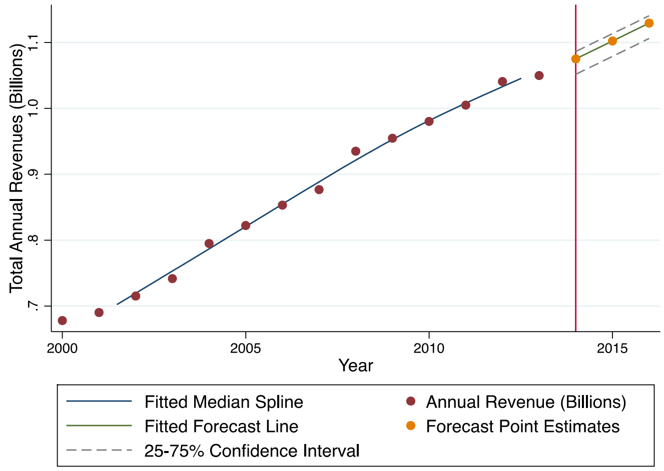

Figure 8. Forecasted revenues generated by the 50 state park systems.

Labor – Trends

The labor required to maintain the states' park systems saw increases from 1984 to the early 2000s (Figure 9). State park system operators reported a high of 56,603 employees in 2002. However since 2002, total employment across the states' park systems has declined. This is notable given the gradual increases in both attendance and acreage over the same time period. The trends illustrate a persistent demand placed upon state park operators to accommodate more users across larger areas with fewer and fewer personnel. This past year's data however, did reveal an uptick in employees. A total of 49,980 positions were reported for 2013, a 0.79% increase over the 49,590 reported in 2012.

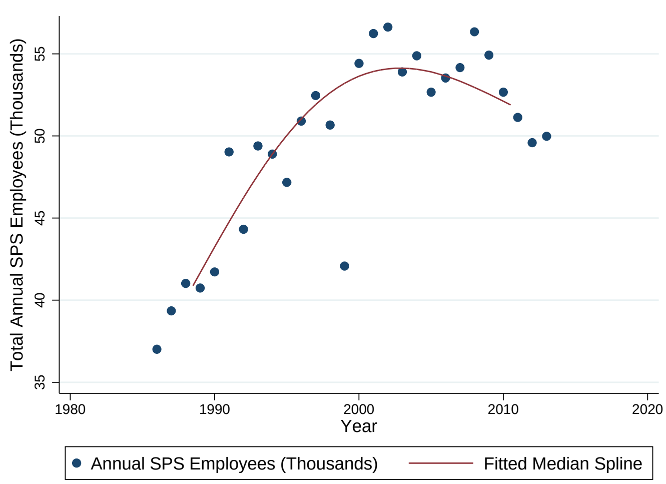

Figure 9. Total labor required to maintain outdoor recreation opportunities provided within the 50 state park systems.

Labor – Forecasts

Fitting our time-trend forecasting model to the labor data suggest the state park systems will gradually add positions over the coming years (Figure 10). Our model predicts total employment to be 55,693 in 2014, eventually rising to 56,475 in 2016. These forecasted estimates are driven, to a large degree by the historical upward trend in employment over the past 30 years; this may mask the recent downward trend seen since 2002.

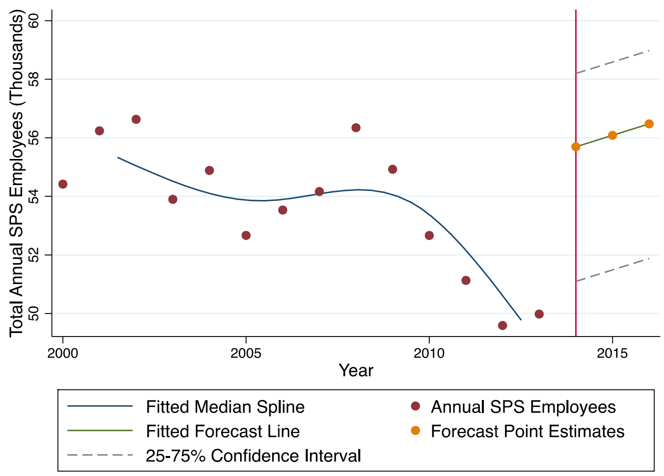

Figure 10. Forecasted labor required to maintain outdoor recreation opportunities provided within the 50 state park systems.

Acreage – Trends

Acreage refers to the total acreage within the states' park systems managed as 'parks', 'recreation areas', 'natural areas', 'historical areas', 'environmental education areas', 'scientific areas', 'forests', 'fish and wildlife areas', and 'other miscellaneous areas' (Leung et al. 2014). The total area managed within the states' park systems has increased steadily since 1984 with notable expansions in recent years (Figure 11). The year 2012 saw a 7.14% increase in acreage over 2011, growing from 1.4 million acres to 1.5 million acres. This past year (2013) saw an increase, albeit to a lesser extent, as acreage rose to 1.53 million acres.

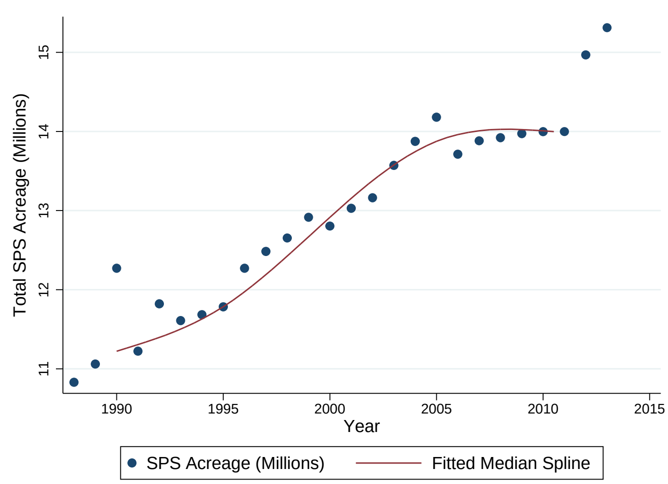

Figure 11. Total acreage within the 50 state park systems.

Acreage – Forecasts

Our time-trend forecasting model fitted to acreage data within the AIX archive suggests the total size dedicated to the states' park systems will continue to increase gradually (Figure 12). Our model predicts total acreage in 2014 will be 1.47 million acres. In 2015 the size is expected to increase to 1.48 million and in 2016, it is expected to reach 1.49 million. These point estimates are likely conservative given the large increase in size reported in 2012 and the fact that acreage managed within the states' park systems rarely declines (Figure 11).

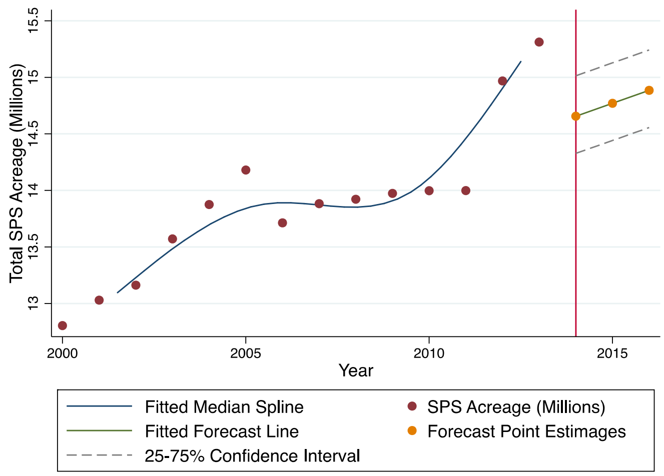

Figure 12. Forecasted acreage within the 50 state park systems.

TECHNICAL EFFICIENCY

Technical efficiency[2] is a concept and metric developed and frequently used by public administration scholars (Schachter 2007). We adopt the definition of technical efficiency by van der Meer and Rutgers (2006: 3) as "the ratio between input and output". Conceptually, technical efficiency is simple. Public resource managers have at their disposal a set of resources, such as labor, built infrastructure and various forms of financial resources, which enable their organization to provide desired goods and services to the public. The goods and services produced through the administration of public resources are outputs which the manager seeks to maximize. Managers pursue the least costly means of achieving given ends (Simon 1976).

For many public resource managers, maximizing technical efficiency is relatively simple and logical; this is often the case when the goals and objectives of a public agency/organization are clear and measureable[3]. Such is the case for the states' park systems, where the primary objective of managers is to provide the public with high quality outdoor recreation opportunities. Conceptually, we assume that all of the states' park system managers are attempting to maximize public enjoyment of the resources they manage (i.e., maximize attendance) while minimizing costs associated with providing and managing those opportunities (i.e., minimizing operating expenditures)[4]. This assumption forms the basis of our analysis of technical efficiency. Managers' efforts to minimize operating expenditures given budgetary constraints is characterized as the technical efficiency model specified below.

Factors of Production in the Provision of Outdoor Recreation Opportunities

We gauge managers' technical efficiency by their ability to minimize financial outlays associated with managing their state's park system (input factors = operating expenditures) in an effort to obtain the factors of production involved in producing outdoor recreation opportunities (output factors). The output factors affecting the efficiency of an individual park system are: attendance, capital expenditures, revenue, labor and the total acreage within the system. We assume each of these output factors affect managers' decisions regarding the magnitude and allocation of operating expenditures:

- *Attendance* refers to the total count of day and overnight visitation to both fee and non-fee areas. Attendance is directly tied to operating expenditures under the logical assumption it costs more (less) to provide outdoor recreation opportunities to a greater (smaller) number of individuals.
- *Capital expenditures* are non-recurring expenditures used to improve the productive capacity of a state park system; typically these are for land acquisition, periodic park improvements and construction. Capital expenditures have a direct, albeit latent, impact on operating expenditures as managers must pay for maintaining improvements paid for as non-recurring capital expenditures (e.g., improvement to transportation infrastructure, trail system development or refinement, etc.).
- *Revenue* refers to monies generated from use fees and other associated charges such cabin and cottage rentals (see Table A1 for full description). Revenues are directly tied to the operating expenditures required to maintain the states' park systems as a portion of the capital available to be spent on operating expenditures is generated through user fees and other charges.

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2 The term "technical efficiency" has been used most frequently within the public administration literatures; Andrews and Entwistle (2013) refer to the identical concept and metric as "productive efficiency."

3 Several scholars from within public administration have argued the use of a simple technical efficiency metric is not always feasible, especially when agencies/organizations are faced with "dual-mandates" or required to manage for multiple, conflicting uses (Andrews and Entwistle 2013; Grandy 2009).

4 Our conceptualization is driven by the fact many legislative appropriation decisions are based upon historical demand for outdoor recreation opportunities provided by a state's park system; it is also driven by data available within the AIX archive. An argument could be made that park managers' do not only seek to maximize attendance and minimize operating expenditures through their decisions. We acknowledge that managers' decisions are also influenced by other objectives such as protecting the states' natural, cultural and ecological resources and providing for the safety of workers and visitors.

- *Labor* refers to the total count of full-time, part-time and seasonal employees who maintain, operate and protect a state park system. Labor is directly tied to operating expenditures as more (fewer) employees will require a larger (smaller) pool of dedicated financial resources to maintain a state park system.
- Finally, *acreage* refers to the total size of a state park system; the measure includes 'parks', 'recreation areas', 'natural areas', 'historical areas', 'environmental education areas', 'scientific areas', 'forests', 'fish and wildlife areas', and 'other miscellaneous areas'. Acreage has direct impacts on operating expenditures; larger (smaller) areas are assumed to require more (less) dedicated financial resources to maintain.

Model Development

As noted above, we assume that all of the states' park system managers are attempting to maximize public enjoyment of the resources they manage while minimizing costs associated with providing and managing those opportunities (i.e., minimizing operating expenditures). This allows us to fit the technical efficiency model by regressing annual operating expenditures on the output factors affecting the production of outdoor recreation opportunities.

All variables used in our analysis are expressed relative to the total acreage within their respective state park system. Summary statistics for all variables are provided in Table 1.

Table 1. Summary statistics for data in the longitudinal panel data set (1984 – 2013)

Variable	Mean	SD	Skewness
Attendance / Acre [a]	119.31	136.59	2.64
Attendance (visitor-hours) / Acre [a]	359.01	410.87	2.65
Operating Expenditures / Acre [b]	379.96	410.69	2.79
Capital Expenditures / Acre [b]	159.90	328.03	7.81
Revenue / Acre [b]	184.14	252.27	3.58
Labor (personnel) / Acre	0.0093	0.0113	2.91
Labor (person-hours) / Acre [c]	19.32	23.51	2.91

Notes.

[a] Using the assumption each visit is 3.010 hours long; this value was derived by taking the estimated 2.2 billion hours of outdoor recreation provided by the states' park systems (Siikamäki 2011) and dividing it by the average annual attendance rates for all the states' park systems over the past 30 years (731,000,000).

[b] Operating expenditures, capital expenditures and revenue are adjusted to a 2013 base rate.

[c] Using the assumption each employee works 2,080 hours per year.

Model Specification

The technical efficiency model is expressed as:

$$y_{jt} = \beta_1 a_{jt} + \beta_2 cx_{jt} + \beta_3 r_{jt} + \beta_4 l_{jt} - u_j + \varepsilon_{jt} \quad (1)$$

The dependent variable *y* refers to the operating expenditures per acre for the $j^{th} = 1,\ldots, 50$ park system in year $t = 1,\ldots,30$. The independent variables are *a* (visitor-hours per acre), *cx* (capital expenditures per acre), *r* (revenue per acre) and *l* (person-hours per acre); these are also indexed to each park system and each year. The individual regression coefficients are expressed as βs. Heterogeneity across the states' park systems is handled through the inclusion of *u*, a fixed effect corresponding to each individual panel (state); this coefficient is time-invariant. Finally, ε refers to random error. All variables are transformed to their natural log (*ln*) before estimation. We fit the model using the *xtreg* command in the Stata statistical software package.

Results

Results of applying the technical efficiency model described above to the longitudinal panel data are shown in Table 2. The model fit the data exceptionally well; the R^2 was 0.90 which suggests our output factors associated with producing outdoor recreation opportunities explain 90% of the variance in reported operating expenditures. A large proportion of our model's explanatory power comes from explicitly modeling the heterogeneity across states (panels) through the u_j term. This is evident through the high rho (ρ) coefficient which reports the proportion of the variance in the dependent measure explained solely by within-panel (within-state) effects. Our model yielded a ρ value of 0.592, suggesting nearly 60% of the variance in reported operating expenditures over the past 30 years can be explained as observed heterogeneity across the states' park systems.

Given the model's exceptional fit, it is unsurprising to find that all of the input factors are highly significant ($p \leq 0.001$). The β coefficients can be interpreted as point elasticities, meaning they indicate the percentage change in operating expenditures given a 1% increase (decrease) in the dependent variable. The β coefficients are also used to calculate the average marginal effect (description included in Table 2); this is the monetary change in operating expenditures corresponding to a 1% increase in a β coefficient's respective variable.

On average, a 1% increase in attendance (visitor-hours) is associated with a 0.245% or $24.87 increase in operating expenditures. More intuitively, we can say that it costs nearly $25 for a state park system manager to produce an additional 3.59 hours of outdoor recreation within their state's park system. Similarly, the model revealed that a 1% increase in capital expenditures is associated with a 0.053 percent increase in operating expenditures. Every $1.60 spent on non-recurring capital expenditures is associated with a concomitant $6.64 increase in costs associated with maintaining existing opportunities for outdoor recreation. Our analysis also suggests a 1% increase in revenue corresponds to a 0.259% increase in operating expenditures. Every $1.84 generated by the states' park systems corresponds to $20.14 in operating expenditures; this is logical given the states' park systems are quasi-public goods whose operating expenditures are only partially funded by generated revenues (state appropriations, dedicated funds and federal funds are also used to pay for operating expenditures). Finally, our model revealed a 1% increase in labor (person-hours) is associated with a 0.292% increase in operating expenditures. More simply, every 11.59 minutes ($M_{Labor\ (person\text{-}hours)/Acre} = 19.32 \times 1\% \times 60$ min./hr.) worked by employees of the states' park systems corresponded to $7.03 in operating expenditures. This finding is intuitive, state park systems with larger labor pools also have larger costs associated with maintaining opportunities within their system.

How Technically Efficient are the States' Park Systems?

Production analyses, such as our model of technical efficiency, are designed to produce a single ratio between input and output factors (Chambers 1988). The factor over which the manager has control is the input factor, in our case this is operating expenditures. The output factors refer to what is being generated by managers' decisions, in our case these are attendance, capital expenditures, revenue and labor. The input factor provides the reference for the technical efficiency ratio given it is both singular and the dependent variable in the analysis. The output factor measure is generated by summing the β coefficients for all of the individual output factors. Values of 1.0 indicate optimal technical efficiency; each additional input factor yields a 100% return across the output factors. Summing the β coefficients generated by our model (Table 2) yields an output factor measure of 0.849 which suggests the states' park operators are highly efficient at developing and maintaining outdoor recreation opportunities within their systems.

Table 2. Results of the technical efficiency model fit to the longitudinal panel data set (1984 – 2013)

Independent Variable	β^a	Std. Error	t	p	95% C.I. U.B.	95% C.I. L.B.	Average Marginal Effect ($)[b]
ln Attendance (visitor-hours) / Acre	0.245	0.017	14.30	≤ 0.001	0.211	0.279	24.87
ln Capital Expenditures / Acre	0.053	0.006	8.49	≤ 0.001	0.041	0.066	6.64
ln Revenue / Acre	0.259	0.016	16.72	≤ 0.001	0.229	0.290	20.14
ln Labor (person-hours) / Acre [c]	0.292	0.019	15.63	≤ 0.001	0.255	0.329	7.03
Constant	2.056	0.080	25.61	≤ 0.001			
ρ^c	0.592						
R^2	0.900						

Notes.

[a] The β coefficients can be interpreted as point elasticities, meaning they indicate the percentage change in operating expenditures given a 1% increase (decrease) in the dependent variable.

[b] Average marginal effects are the monetary change in operating expenditures corresponding to a 1% increase in a β coefficient's respective variable; they are calculated as $\bar{x}^{\beta} \times \ln(\bar{x})$ where $\bar{x}$ is the variable mean.

[c] The proportion of the variance in the dependent measure explained solely by within-panel (within-state) effects.

Technical Efficiency Rankings by Individual State Park Systems

We noted above the majority of our technical efficiency model's explanatory power came from the inclusion of a within-panel (state) estimator (the u_j term). In fact, a full two-thirds of the variance in operating expenditures can be accounted for through the within-panel (state) estimator alone; this is exhibited by the 0.592 rho (ρ) coefficient. These modeling results suggest the high probability of considerable heterogeneity in the technical efficiency across individual state park systems. This between-panel (state) heterogeneity can be characterized by calculating individual technical efficiency scores for each of the states' park systems.

Individual technical efficiency scores are computed through the following equation:

$$Technical\ Efficiency_j = \frac{1}{\exp(u_j)} \tag{2}$$

Here, u_j is simply the estimated fixed effect from Equation 1; it is unique for each of the $j = 1,\ldots, 50$ park systems. Because u_j estimates are derived through the technical efficiency model for all 50 park systems, they are expressed relative to a theoretical maximum in which the state-level ratio between input and output factors is 1.0. State's whose park systems yield technical efficiency scores greater than 1.0 are operating above the theoretical maximum. Likewise, states with technical efficiency scores less than 1.0 are operating below the theoretical maximum. We calculated the state-level technical efficiency scores using Equation 2 and report the results in Table 3. To ease interpretation, we also rank individual states' park systems by their scores.

The state-level technical efficiency scores are consistent with those we published in 2013 as noted in Column 3 and 6 of Table 3 (Siderelis and Leung 2013). The Alaska State Park System continues to be the most efficient at jointly producing the output factors of attendance, revenue and labor with minimal operating costs. The South Dakota, Nebraska, New Hampshire and Colorado state park systems round out the top five systems that have most efficiently produced outdoor recreation opportunities over the past 30 years. Several state park systems did see notable changes in their technical efficiency rankings: Hawaii jumped from 40th to 31st; Maryland went from 24th to 19th; Missouri moved from 33rd to 28th; New Jersey improved from 26th to 20th; Ohio moved from 29th to 24th; and Washington state leapt from 30th to 22nd. Montana's state park system saw the most substantial gain, moving from 28th to 16th. Moving in the other direction: New York (21st to 32nd) and Wyoming (27th to 36th) both dropped 11 spots; Massachusetts slipped from 16th to 27th; North Carolina dropped from 23rd to 30th; and both Virginia (20th to 26th) and West Virginia (17th to 23rd) moved down six spots.

Table 3. Individual state park systems' technical efficiency scores and rankings.

State	Technical Efficiency Score [a]	2014 Rank (2013 Rank)	State	Technical Efficiency Score [a]	2014 Rank (2013 Rank)
Alabama	0.707	44 (44)	Montana	1.070	16 (28)
Alaska	1.766	1 (1)	Nebraska	1.642	3 (3)
Arizona	0.661	48 (48)	Nevada	1.040	17 (18)
Arkansas	0.767	41 (39)	New Hampshire	1.563	4 (2)
California	0.669	47 (45)	New Jersey	1.016	20 (26)
Colorado	1.507	5 (5)	New Mexico	0.763	42 (43)
Connecticut	1.458	7 (6)	New York	0.944	32 (21)
Delaware	0.865	37 (36)	North Carolina	0.949	30 (23)
Florida	0.987	25 (22)	North Dakota	1.266	10 (10)
Georgia	0.716	43 (42)	Ohio	0.995	24 (29)
Hawaii	0.944	31 (40)	Oklahoma	0.844	38 (41)
Idaho	0.930	34 (31)	Oregon	0.928	35 (38)
Illinois	0.843	39 (35)	Pennsylvania	0.796	40 (37)
Indiana	1.372	9 (8)	Rhode Island	1.165	15 (15)
Iowa	1.231	12 (14)	South Carolina	1.034	18 (19)
Kansas	1.237	11 (13)	South Dakota	1.669	2 (4)
Kentucky	0.604	49 (46)	Tennessee	0.956	29 (32)
Louisiana	0.557	50 (50)	Texas	1.015	21 (25)
Maine	1.172	14 (12)	Utah	0.682	46 (49)
Maryland	1.016	19 (24)	Vermont	1.182	13 (11)
Massachusetts	0.971	27 (16)	Virginia	0.975	26 (20)
Michigan	1.394	8 (7)	Washington	1.013	22 (30)
Minnesota	0.930	33 (34)	West Virginia	1.011	23 (17)
Mississippi	0.707	45 (47)	Wisconsin	1.506	6 (9)
Missouri	0.962	28 (33)	Wyoming	0.901	36 (27)

Notes.
[a] A score of 1.0 is the theoretical maximum.

IMPACTS OF CLIMATE CHANGE MITIGATION POLICY

Proactive policy-makers within the US have proposed a variety of national policies and/or frameworks for reducing GHG emissions and curbing anthropogenic climatic change. A large majority of these policies and/or frameworks establish a cap-and-trade system in which a regulatory agency establishes emission reductions targets, the ‘cap’, and then distributes permits to states and industries that allow them to emit a certain level of CO_2e emissions. Permits can be traded in a new marketplace between firms with higher emission reduction costs to/from those with low GHG control costs. In many policies and/or frameworks, permits can be ‘banked’ by regulated organizations for future use. Conceptually, the price of permits will be established through an open marketplace; the price will gradually increase over time as the allowable CO_2e cap is reduced to target levels. Industries and organizations behave in a cost-minimizing fashion, continually comparing the option of adopting cleaner technologies which allow them to meet their established quota, or purchasing permits via the marketplace allowing them to continue to emit GHGs beyond regulated levels.

Numerous macroeconomic studies demonstrate the adoption of national cap-and-trade policies will impact the US economy. Most studies share two key findings: First, the negative economic impacts will be minimal. For example, Ross et al. (2008) and Jorgenson et al. (2008) utilize a computationally-intensive general equilibrium model of the US economy to project slight declines to the nation’s GDP over the next 10 years if a national cap-and-trade system were implemented. Decrements to GDP are generally on the order of one or two one-hundredths of a percent per year.

The second commonality among these studies is that impacts on individual states’ economies will vary depending upon those states’ current carbon intensities and mix of emission sources. States with large proportions of their energy production portfolio devoted to emission-heavy technologies such as coal-fired power plants are likely to experience the largest regulatory burden (Backus, Lowry, and Warren 2013). Similarly, states whose economies have large agriculture and livestock industries are likely to face difficult near-term decisions concerning how to reduce the high levels of GHG emissions generated from those industries. For example, Midwestern state governments and their agricultural industries have already placed significant investments into transitioning land used for food production to biofuels production, thus offsetting generated emissions (Timilsina and Mevel 2013). Simply put, the health of the states’ economies will be differentially impacted by the adoption of a national climate change mitigation policy.

Most formal analyses of the economic impacts of emission reduction strategies make direct connections to states’ gross domestic product, the market value of all officially recognized final goods and services produced within a state in a single year. Logically, it follows that public services tied to the health of the states’ economies will be indirectly affected by policy change. The provision of nearly all public services is dependent, at least partially, on state legislative appropriations generated through property, income and sales tax. When a state’s economy slows, state tax receipts are reduced and government officials are faced with the difficulty of providing public services with reduced resources. State parks systems and the managers responsible for producing outdoor recreation opportunities are not exempt from this linkage. In fact, through previous analyses of the AIX archive we found states’ economies to be significantly tied to both the production (operating expenditures) and consumption (attendance) of outdoor recreation across the states’ park systems (Siderelis and Smith 2013). If an analyst is able to demonstrate an empirical, long-term and significant linkage between the health of a state’s economy and any singular public good, they can forecast changes to the production of that public good into the future under variable rates of economic growth.

To demonstrate an empirical linkage between the health of the states’ economies and outdoor recreation opportunities provided by the states’ park systems, and then forecast variable changes to the production of outdoor recreation into the future, we utilize the following 4-step process:

1. We re-estimate our technical efficiency model using the longitudinal panel data for the past 30 years, only this time we include measures of the states' overall economic well-being (gross state product (GSP)).
2. We utilize forecasted changes to states' GSP under a national emission reduction strategy generated by a well-know computable general equilibrium (CGE) model (Jorgenson et al. 2008; Ross et al. 2008).
3. We perform three dynamic forecasts with our technical efficiency model fitted to an extended longitudinal panel data set that includes the variable changes to GSP derived from the CGE model. The dynamic forecasting data extend to they year 2020.
4. Finally, we calculate point estimates generated from each of the dynamic forecasting models at their final time-step, the year 2020. These point estimates are compared against each other to determine if, and to what extent, the adoption of a GHG reduction policy impacts the ability of the states' park managers to produce outdoor recreation opportunities. *Simply put, we are determining whether changes to GSP over the next six years attributable solely to a climate change mitigation policy affect forecasted operating expenditures over the same time period.*

The analysis is a direct test of whether national emission reduction strategies affect the ability of public administrators to produce desired goods and services to the public. Consequently, the results hold direct implications for both the states' elected officials who are presumably responsible to the needs and desires of their constituents and the states' park managers who may be indirectly impacted by the implementation of a federal climate change mitigation policy.

The Applied Dynamic Analysis of the Global Economy (ADAGE) Model

Our analysis utilizes results generated from two GHG reduction policy alternatives simulated with a computable general equilibrium (CGE) model of the US economy (Ross 2007). CGE models combine economic theory with empirical data to estimate how the effects of a policy with no historical precedent will affect all interactions among businesses and consumers within an economy. CGE models are common in the analysis of climate change mitigation policy, having been used to examine impacts associated with The Kyoto Protocol (Weyant et al. 1996; Böhringer 2000), other international carbon abatement policies (Ross, Fawcett, and Clapp 2009) and failed domestic policies such as the *American Power Act*, the *American Clean Energy and Security Act*, and *Climate Stewardship and Innovation Act* (US Environmental Protection Agency 2007; US Environmental Protection Agency 2010a; US Environmental Protection Agency 2010b).

Our analysis utilizes policy simulation results reported by Ross et al. (2008). The simulations run were not specific to a real national mitigation policy. Rather they were specified using commonly proposed policy provisions; these were:

- A US GHG emissions target established at year 2000 emissions levels, beginning in 2010
- Emission regulation on CO_2 and the five most important types of non-CO_2 GHGs
- A nationwide cap-and-trade system (with some exemptions for households, agriculture and small businesses). The system gives affected organizations/firms the option to reduce their emissions, purchase allowances (i.e., credits) giving them the right to emit GHGs or sell allowances if they have low-cost opportunities to reduce emissions below the number of allowances they receive under the policy scenario
- Several 'flexibility mechanisms' such as the flexibility to overcomply and save, or 'bank', allowances for use in the future and the ability to acquire allowance 'offsets' equivalent to 15% of the target through emissions reductions made by sources outside the trading system

The economic impacts incurred to individual organizations, firms and households will be determined by the availability and costs of allowance offsets generated by emission reductions options available outside the cap-and-trade system. For example, private firms can purchase and/or trade allowances on international GHG markets or fund carbon sequestration projects. Consequently, financial costs have a theoretical lower bound to $0 if an organization/firm engages in options outside the domestic regulatory system. Given this, simulations run with the ADAGE model yield both lower and upper bounds when estimating impacts.

Upper- and Lower-Bounds: Free Offsets versus Market Offsets

Under the ‘free offsets scenario’ the full 15% of allowance offsets allowed under the hypothetical policy are assumed to be available at no cost. This lower-bound approximation represents what would occur if allowances could be made from international GHG markets at a marginal costs or large quantities of inexpensive carbon sequestrations options were available.

The ‘market offsets scenario’ is a more restrictive case where offsets are assumed to be available from emissions reductions made by non-covered domestic entities at a market costs estimated within the model (i.e., it assumes international markets do not exist and no allowance offsets can be generated through carbon sequestration activities).

Re-estimation of Technical Efficiency Model

In previous analyses of data within the AIX archive, we found the health of the states’ economies was significantly related to both the production (operating expenditures) and consumption (attendance) of outdoor recreation opportunities provided through the nation’s state park systems (Siderelis and Smith 2013). In this previous analysis, our measure of the states’ economic health was an average of the monthly state coincident index, a measure published by the Philadelphia Federal Reserve Bank. The state-level coincident index is a composite measure combining nonfarm payroll employment, average hours worked in manufacturing, the unemployment rate and wage and salary disbursements adjusted to the consumer price index (Crone and Clayton-Matthews 2005).

While the coincident index is a good measure of the states’ economic health, its composite nature limits its ability to be linked to more commonly used metrics used to evaluate impacts of hypothetical policy implementation. Consequently, for this year’s analysis we use state-level GDP as a measure of the states’ economic health. State-level GDP is a widely used metric used to forecast and simulate the consequences of both federal and regional climate change mitigation alternatives (Ruth, Coelho, and Karetnikov 2007). We obtained state-level GDP data for the years 1983 to 2012 from the US Bureau of Economic Analysis (www.bea.gov)[5].

The technical efficiency model, with the inclusion of state-level GDP measures, is expressed as:

$$y_{jt} = \beta_1 a_{jt} + \beta_2 cx_{jt} + \beta_3 r_{jt} + \beta_4 l_{jt} + \beta_5 gdp_{jt-1} - u_j + \varepsilon_{jt} \quad (3)$$

Again, *y* refers to the operating expenditures per acre for each of the *j* park systems across each of the past *t* years. The variable *a* references visitor-hours per acre, *cx* references capital expenditures per acre, *r* indicates revenues per acre, *l* indicates person-hours per acre and *gdp* refers to gross domestic product per acre. All of the independent variables are indexed to individual park systems and years. However, given states’ legislative appropriations are, to a large extent, based on tax revenues from the previous year, we lag the GDP data one year in our analysis (e.g., the states’ GDP for 2003 are used to predict the 2004 operating expenditures of their park systems). Again, individual regression coefficients are indicated by

[5] All data adjusted to 2013 US dollars using the consumer price index (CPI) for all urban consumers (www.bls.gov).

the βs and the u_j term is a time-invariant fixed-effect panel estimator. Of course, ε refers to random error. We transformed all variables to their natural log (*ln*) before estimation.

Results

Re-estimation of the technical efficiency model including the annual state GDP covariate revealed, as would be expected, very similar results to the initial model. The independent variables (output factors of production and states' GDP) explained a substantial proportion of observed variance in state park systems' operating expenditures (R^2 = 0.89). The vast majority of explained variance is attributable to within-panel (state) effects (ρ = 0.69).

Results, shown in Table 4, for all of the output factors of production retained relative effect size measures (β coefficients) and were highly significant. The model also suggests states' gross state product has a significant effect on their state park systems' annual operating expenditures. States with larger gross state products, on average, have larger annual operating expenditures; this finding is consistent with previous analysis utilizing the alternative coincidence index to gauge the states' economic health (Siderelis and Leung 2013; Siderelis and Smith 2013). A 1% increase (decrease) in a states' GDP results in a 0.476% increase (decrease) in their state park system's operating expenditures the following year.

Table 4. Results of the technical efficiency model including the annual state GDP data

					95% C.I.	
Independent Variable	β	Std. Error	t	p	U.B.	L.B.
ln Attendance (visitor-hours) / Acre	0.156	0.016	9.63	≤ 0.001	0.124	0.187
ln Capital Expenditures / Acre	0.032	0.006	5.58	≤ 0.001	0.021	0.043
ln Revenue / Acre	0.123	0.016	7.83	≤ 0.001	0.093	0.154
ln Labor (person-hours) / Acre [c]	0.200	0.018	11.43	≤ 0.001	0.166	0.235
ln Gross State Product$_{t-1}$ / Acre	0.476	0.018	18.48	≤ 0.001	0.425	0.527
Constant	3.287	0.026	33.45	≤ 0.001	3.094	3.479
ρ [a]	0.690					
R^2	0.890					

Notes.
[a] The proportion of the variance in the dependent measure explained solely by within-panel (within-state) effects.

Dynamic Forecasting

Given substantial heterogeneity in GSP measures, we generated state-specific forecasts for the years 2014 to 2020. Forecasted GSP measures were created through state-specific time-trend regression models fit to all 30 years of the data[6]. The regression of each states' lagged GSP on year is specified as:

$$gdp_{t-1} = t + \varepsilon_t \tag{4}$$

Given these data represent GSP forecasts using only observed measures, we use them to define our *business as usual* scenario.

Changes to GSP under the *free offsets scenario* and the *market offsets scenario* for the years 2014 to 2020 were derived by using annual estimates generated by the ADAGE computational general equilibrium model (Ross et al. 2008). For convenience, we have report these estimates in Table 5. We multiplied these proportional changes by forecasted GSP values for their corresponding year. The resulting raw GSP forecasts under both forecasts were lagged, converted to they per acre unit of measurement[7] and

[6] See Smith's `gdp_imputation.do` file.

[7] This assumes the states' park systems will remain at their 2013 acreage until the end of our forecasting period, 2020.

transformed to their natural logarithms. This transformation enables us to proceed with the formal dynamic forecasting process.

Table 5. Estimated changes to US GDP from 2014 to 2020 under both a free-offsets scenario and a no-offsets scenario

Year	Free Offsets Scenario (%)	Market Offsets Scenario (%)
2014	-0.010	-0.040
2015	-0.028	-0.058
2016	-0.047	-0.077
2017	-0.065	-0.095
2018	-0.083	-0.113
2019	-0.102	-0.132
2020	-0.120	-0.240

Notes. Values are derived from the ADAGE CGE model (Ross et al. 2008)

Dynamic forecasting involves generating out-of-sample estimates for a regression equation where all but one 'dynamic' variable is allowed to change, all other covariates are held constant. This process allows an analyst to explicitly gauge how the change in the dynamic independent variable influences projected estimates of the dependent variable. In our case, we are able to see how CGE-derived changes in GDP affect each of the state park systems' operating expenditures over the next six years.

We ran three dynamic forecasting models with our longitudinal panel data set that, with the inclusion of the estimated changes to GSP, now spans the years 1984 to 2020. The first model includes GSP projections derived from the state-specific time-trend regression; model specification is identical to Equation 3. The second model includes historical GSP rates for years 1984 to 2013 and projected GSP rates under the free offsets scenario for the years 2014 to 2020. The third and final model substitutes in projected GSP rates under the market offsets scenario for the years 2014 to 2020. After estimation of each model, point estimates of each state park system's operating expenditures for the year's 2014 to 2020 were generated from the linear predictions; estimates were transformed into 2013 dollars through exponentiation. We report the last year, 2013, of observed operating expenditures per acre along with transformed estimates generated by each of the forecast models in Table 6.

Comparison of Operating Expenditures Point Estimates

Under the business as usual scenario, Column 4 of Table 6 illustrates the vast majority of states will experience increases in operating expenditures if their economies continue on the trajectories defined by the previous 30 years. On average, the states' park systems will see an increase in annual operating expenditures per acre of $68. Rhode Island's state park system is likely to experience the largest increase in operating expenditures per acre (+$460). Oklahoma (+$305), Georgia (+$284) and Mississippi (+$254) are also likely to experience substantial increases in operating costs per acre over the coming years. Some states however, will experience declines in operating expenditures. Minnesota's state park system's operating expenditures will decline by $87 dollars per acre by the end of the decade. Similarly, Indiana's state park system is projected to see a drop in operating expenditures by $40 per acre over the same time period.

Results from the free offsets scenario forecast reveal similar trends when looking at expected changes by 2020 (Column 6 of Table 6). On average, the states' park systems will see an increase in annual operating expenditures per acre of $49 under a federal GHG reduction strategy. This result reveals the real costs of a federal climate change policy on the operations of the states' park systems. Relative to the business as usual scenario, the free offsets scenario will, on average, result in a $20 per acre reduction in operating expenditures for the states' park systems. The free offsets scenario's marginal negative impacts on GDP are likely to 'trickle down' and be felt by the states' park systems. State park managers, on average, will be faced with the burden of maintaining current outdoor recreation opportunities with smaller pools of money to allocate to operating costs.

Results from the market offsets scenario are similar. On average, the state park systems' operating expenditures per acre are projected to increase $43 by 2020 (Column 9 of Table 6). Relative to the business as usual scenario, operating expenditures per acre are expected to be $26 per acre less by the end of the decade (Column 10 of Table 6). Again, these findings reveal the real, indirect effects on the decisions of state park operators as a result of federal GHG reduction efforts. It is important to note, however, that projected changes in operating expenditures are far from homogeneous; states like Kentucky (-\$98 $\Delta_{BAU\text{-}FOS}$, -\$128 $\Delta_{BAU\text{-}MOS}$), Rhode Island (-\$71 $\Delta_{BAU\text{-}FOS}$, -\$92 $\Delta_{BAU\text{-}MOS}$) and Delaware (-\$56 $\Delta_{BAU\text{-}FOS}$, -\$74 $\Delta_{BAU\text{-}MOS}$) are expected to see the most significant changes to their operating costs. States like Alaska (-\$0.14 $\Delta_{BAU\text{-}FOS}$, -\$0.19 $\Delta_{BAU\text{-}MOS}$), Colorado (-\$2 $\Delta_{BAU\text{-}FOS}$, -\$2 $\Delta_{BAU\text{-}MOS}$) and New Hampshire (-\$3 $\Delta_{BAU\text{-}FOS}$, -\$4 $\Delta_{BAU\text{-}MOS}$) however, are expected to see very little change. This variation is wholly driven by different GSP growth trajectories and historical trends in operating expenditures per acre. States with technically efficient state park systems like those in Alaska and Colorado, and states with strong GSP growth, like New Hampshire, are less likely to experience substantial reductions in operating costs.

Policy and Managerial Implications

The results of our dynamic forecasting model applied to the longitudinal panel data set reveal the real, indirect effects on the decisions of state park operators as a result of federal GHG reduction efforts. As states' GDP levels are impacted by the transition to renewable energy sources and more sustainable land use practices, appropriations to the states' park systems will see reciprocal decreases. In turn, capital available to maintain high-quality outdoor recreation opportunities (measured via operating expenditures) will be reduced. Our forecasting revealed the adoption of a federal cap and trade policy would reduce the operating budgets of the states' park systems by an average of $18 (free offsets scenario) to $27 (market offsets scenario) per acre by the year 2020. This effect may seem marginal when viewed in the aggregate, however there is considerable heterogeneity across the states (Table 6).

States with rapidly growing economies (i.e., greater year over year increases in GSP) and high technical efficiency scores (Table 3) are expected to experience only minor declines if a GHG reduction policy were implemented (-\$0.14 $\Delta_{BAU\text{-}FOS}$, -\$0.19 $\Delta_{BAU\text{-}MOS}$). Colorado (-\$2 $\Delta_{BAU\text{-}FOS}$, -\$2 $\Delta_{BAU\text{-}MOS}$), Connecticut (-\$4 $\Delta_{BAU\text{-}FOS}$, -\$6 $\Delta_{BAU\text{-}MOS}$) and New Hampshire's (-\$3 $\Delta_{BAU\text{-}FOS}$, -\$4 $\Delta_{BAU\text{-}MOS}$) state park systems are further exemplars of high technical efficiency and marginal impacts to operating expenditures under a national GHG reduction policy.

So what are the best strategies for states to cope with the probability of increasingly restricted operating budgets once a national GHG reduction strategy is implemented? Our analysis can point to two possible solutions: First, encourage rapid economic growth and increases in GSP. This strategy is logical. Increases in GSP will lead to increased appropriations in the states' operating budgets and subsequent increases in allocations to operating expenditure by managers. The data for some states suggests this may be a good strategy. For example, Nevada has experienced the highest annual GSP growth rate over the past 29 years (4.61%) and is estimated to only see marginal impacts to their state park system's operating costs over the next six years under either of the GHG mitigation scenarios (-\$5 $\Delta_{BAU\text{-}FOS}$, -\$7 $\Delta_{BAU\text{-}MOS}$). The data from Florida reveals a similar trend; the state has experienced the seventh largest increase in annual GSP growth over the past thirty years and is expected to incur relatively minor impacts to their state park system's operating budget as a direct result of the adoption of a federal GHG reduction policy (-\$7 $\Delta_{BAU\text{-}FOS}$, -\$10 $\Delta_{BAU\text{-}MOS}$).

An alternative solution is to increase technical efficiency—that is, become more efficient in the use of operating costs to produce and/or manage visitation, labor and parklands. Mathematically, more technically efficient state park systems will have more ‘leeway’ to become more inefficient relative to other states as they can produce and/or manage more visitation, labor and parklands with less operating costs. Again we see several states that highlight this logic. Alaska’s state park system is the most technically efficient in the country and is expected to incur a very minor impact to operating expenditures under the adoption of a GHG reduction policy (-\$2 $\Delta_{BAU\text{-}FOS}$, -\$4 $\Delta_{BAU\text{-}MOS}$).

To explore possible policy recommendations for the states’ park systems, we calculate simple rank-order correlations between the annual growth rate between 1983-2012, our previously computed technical efficiency score (Table 3) and the decrement in operating expenditures under a national GHG reduction policy; Table 7 provides the full rank ordering. The correlation analysis revealed only a minor correlation between a state’s annual GSP growth rate and the projected impact to that state’s park system operating costs (r = -0.044). Conversely, the analysis revealed a substantial correlation between a state park system’s technical efficiency and the projected impact to that state park system’s operating costs (r = 0.499). This exploratory analysis suggests even states with higher GSP growth rates cannot escape the indirect impacts of a federal climate change mitigation policy. Rather, the data suggest a much more viable solution lies in improving the efficiency by which state park systems produce or maintain visitation, labor and parklands with given operating outlays. In summation, our modeling reveal more technically efficient state park systems will be more resilient to exogenous economic changes, such as those brought about through the adoption of a federal climate change mitigation policy.

Table 6. Forecasted changes to the states' park systems operating expenditures per acre under climate a change mitigation policy.

	Business as Usual (BAU) Scenario			Free Offsets Scenario			Market Offsets Scenario		
State	2013	2020	Δ	2020	$\Delta_{2013\text{-}2020}$	Δ_{BAU}	2020	$\Delta_{2013\text{-}2020}$	Δ_{BAU}
Alabama	902.33	1027.97	125.64	976.66	74.33	-51.32	960.99	58.66	-66.98
Alaska	4.04	2.90	-1.13	2.76	-1.28	-0.14	2.71	-1.32	-0.19
Arizona	278.28	375.76	97.47	357.00	78.72	-18.76	351.27	72.99	-24.48
Arkansas	1017.14	1040.20	23.06	988.27	-28.87	-51.93	972.42	-44.72	-67.78
California	240.88	276.18	35.30	262.40	21.52	-13.79	258.19	17.31	-18.00
Colorado	41.70	34.74	-6.96	33.01	-8.69	-1.73	32.48	-9.22	-2.26
Connecticut	81.54	86.06	4.53	81.77	0.23	-4.30	80.46	-1.08	-5.61
Delaware	896.01	1127.32	231.31	1071.04	175.04	-56.27	1053.86	157.85	-73.46
Florida	97.80	145.92	48.11	138.63	40.83	-7.28	136.41	38.61	-9.51
Georgia	483.34	766.92	283.57	728.63	245.29	-38.28	716.94	233.60	-49.97
Hawaii	250.38	320.47	70.08	304.47	54.08	-16.00	299.58	49.20	-20.88
Idaho	275.15	327.10	51.95	310.78	35.63	-16.33	305.79	30.64	-21.31
Illinois	147.98	148.52	0.54	141.10	-6.88	-7.41	138.84	-9.14	-9.68
Indiana	334.89	294.72	-40.17	280.01	-54.88	-14.71	275.52	-59.37	-19.20
Iowa	215.26	256.26	40.99	243.47	28.20	-12.79	239.56	24.29	-16.70
Kansas	71.61	85.06	13.45	80.81	9.20	-4.25	79.52	7.91	-5.54
Kentucky	1803.20	1966.83	163.63	1868.65	65.45	-98.18	1838.67	35.47	-128.16
Louisiana	657.54	629.38	-28.16	597.97	-59.58	-31.42	588.37	-69.17	-41.01
Maine	76.13	107.75	31.62	102.37	26.24	-5.38	100.73	24.60	-7.02
Maryland	254.06	378.79	124.74	359.89	105.83	-18.91	354.11	100.06	-24.68
Massachusetts	180.75	200.56	19.81	190.55	9.80	-10.01	187.49	6.74	-13.07
Michigan	197.90	220.96	23.06	209.93	12.03	-11.03	206.57	8.66	-14.40
Minnesota	268.89	182.10	-86.79	173.01	-95.88	-9.09	170.24	-98.65	-11.87
Mississippi	520.53	774.45	253.92	735.79	215.26	-38.66	723.99	203.46	-50.46
Missouri	225.33	201.13	-24.20	191.09	-34.24	-10.04	188.02	-37.30	-13.11
Montana	174.96	194.46	19.50	184.75	9.79	-9.71	181.79	6.83	-12.67
Nebraska	175.08	198.83	23.76	188.91	13.83	-9.93	185.88	10.80	-12.96
Nevada	72.34	102.89	30.55	97.75	25.41	-5.14	96.18	23.85	-6.70
New Hampshire	85.85	67.51	-18.34	64.14	-21.71	-3.37	63.11	-22.74	-4.40
New Jersey	77.47	120.45	42.98	114.43	36.96	-6.01	112.60	35.13	-7.85
New Mexico	87.10	117.86	30.76	111.98	24.88	-5.88	110.18	23.08	-7.68
New York	165.86	193.99	28.13	184.31	18.45	-9.68	181.35	15.49	-12.64
N. Carolina	166.96	201.61	34.65	191.55	24.58	-10.06	188.47	21.51	-13.14
N. Dakota	154.44	136.51	-17.92	129.70	-24.74	-6.81	127.62	-26.82	-8.90
Ohio	354.66	518.89	164.22	492.98	138.32	-25.90	485.07	130.41	-33.81
Oklahoma	413.70	718.80	305.10	682.92	269.21	-35.88	671.96	258.26	-46.84
Oregon	511.03	645.82	134.79	613.59	102.55	-32.24	603.74	92.71	-42.08
Pennsylvania	279.17	359.08	79.91	341.15	61.98	-17.93	335.68	56.51	-23.40
Rhode Island	958.51	1418.39	459.87	1347.58	389.07	-70.81	1325.96	367.45	-92.42
S. Carolina	289.31	360.30	70.99	342.31	53.00	-17.99	336.82	47.51	-23.48
S. Dakota	170.86	201.16	30.30	191.12	20.26	-10.04	188.05	17.20	-13.11
Tennessee	411.49	515.54	104.04	489.80	78.31	-25.74	481.94	70.45	-33.59
Texas	118.66	133.33	14.67	126.68	8.01	-6.66	124.65	5.98	-8.69
Utah	103.63	252.88	149.25	240.26	136.63	-12.62	236.40	132.77	-16.48
Vermont	121.46	153.27	31.81	145.62	24.16	-7.65	143.28	21.83	-9.99
Virginia	488.91	515.83	26.92	490.08	1.17	-25.75	482.22	-6.69	-33.61
Washington	516.91	570.00	53.09	541.55	24.64	-28.45	532.86	15.95	-37.14
West Virginia	235.45	262.07	26.63	248.99	13.55	-13.08	245.00	9.55	-17.08
Wisconsin	150.82	179.45	28.63	150.82	0.00	-28.63	70.05	-80.77	-109.40
Wyoming	70.05	92.40	22.35	170.49	100.44	78.09	87.79	17.74	-4.62
Average	**317.55**	**384.19**	**66.64**	**366.27**	**48.72**	**-17.92**	**357.23**	**39.68**	**-26.96**

Notes. All values are 2013 US dollars.

Table 7. Original and ranked annual GSP growth rates, technical efficiency scores and change in operating expenditures for each state/state park system.

State	Annual GSP Growth Rate	Rank	Technical Efficiency Score	Rank	ΔOperating Expenditures	Rank
Alabama	1.795	35	0.707	44	-51.320	46
Alaska	-0.152	50	1.766	1	-0.140	2
Arizona	3.611	2	0.661	48	-18.760	34
Arkansas	2.059	25	0.767	41	-51.930	47
California	2.347	20	0.669	47	-13.790	28
Colorado	2.840	11	1.507	5	-1.730	3
Connecticut	1.891	31	1.458	7	-4.300	6
Delaware	3.339	4	0.865	37	-56.270	48
Florida	3.018	7	0.987	25	-7.280	13
Georgia	2.998	8	0.716	43	-38.280	44
Hawaii	1.947	28	0.944	31	-16.000	30
Idaho	2.509	16	0.930	33	-16.330	31
Illinois	1.793	36	0.843	39	-7.410	14
Indiana	2.039	26	1.372	9	-14.710	29
Iowa	1.837	32	1.231	12	-12.790	26
Kansas	1.727	40	1.237	11	-4.250	5
Kentucky	1.721	41	0.604	49	-98.180	50
Louisiana	0.959	48	0.557	50	-31.420	41
Maine	1.825	34	1.172	14	-5.380	8
Maryland	2.640	15	1.016	19	-18.910	35
Massachusetts	2.065	24	0.971	27	-10.010	20
Michigan	0.927	49	1.394	8	-11.030	24
Minnesota	2.389	19	0.930	33	-9.090	16
Mississippi	1.697	42	0.707	44	-38.660	45
Missouri	1.734	39	0.962	28	-10.040	21
Montana	1.617	43	1.070	16	-9.710	18
Nebraska	2.242	22	1.642	3	-9.930	19
Nevada	4.613	1	1.040	17	-5.140	7
New Hampshire	2.651	14	1.563	4	-3.370	4
New Jersey	2.038	27	1.016	19	-6.010	10
New Mexico	1.826	33	0.763	42	-5.880	9
New York	1.735	38	0.944	31	-9.680	17
N. Carolina	3.140	6	0.949	30	-10.060	23
N. Dakota	2.256	21	1.266	10	-6.810	12
Ohio	1.327	44	0.995	24	-25.900	38
Oklahoma	1.183	46	0.844	38	-35.880	43
Oregon	3.147	5	0.928	35	-32.240	42
Pennsylvania	1.737	37	0.796	40	-17.930	32
Rhode Island	1.895	30	1.165	15	-70.810	49
S. Carolina	2.505	17	1.034	18	-17.990	33
S. Dakota	2.722	13	1.669	2	-10.040	21
Tennessee	2.460	18	0.956	29	-25.740	36
Texas	2.755	12	1.015	21	-6.660	11
Utah	3.555	3	0.682	46	-12.620	25
Vermont	2.077	35	1.182	13	-7.650	15
Virginia	2.975	50	0.975	26	-25.750	37
Washington	2.922	2	1.013	22	-28.450	39
West Virginia	1.210	25	1.011	23	-13.080	27
Wisconsin	1.900	20	1.506	6	-28.626	40
Wyoming	1.125	11	0.901	36	78.093	1

Notes.

APPENDIX A

An Overview of the AIX

All analyses in this report utilize data collected from the Annual Information Exchange (AIX), a data collection and reporting system contracted to NC State University by the National Association of State Park Directors (NASPD). The AIX system is intended primarily for use by state park system operators and staff for purposes such as: identifying program, facility and personnel needs; formulating budgetary requests for state legislatures; and comparing their programs with those of other states. Data collected by the AIX system include:

- an inventory of the number, acreage, and type of areas managed by each state park system;
- an inventory of the number and type of facilities managed by each state park system;
- annual attendance counts broken down by fee-areas, non-fee areas, day-use areas, and overnight use areas;
- annual capital and operating expenditures by each state park system;
- annual revenue generated by source (e.g., entrance fees, cabin rentals, etc.) for each state park system ; and
- an inventory of the number and type of personnel positions required to maintain each state park system, this includes salary ranges and an inventory of employee benefits.

Each year, the AIX project team prepares a *Statistical Report of State Park Operations*, which details the data collection process and provides detailed definitions and descriptions of the reported data (Leung et al. 2014). Users of the data are encouraged to use these reports to guide interpretation of the data. Individuals or organizations interested in utilizing data in the AIX system should contact the AIX Project Team lead, Dr. Yu-Fai Leung at leung@ncsu.edu.

Variables Pulled From the AIX

To conduct the analyses described in this report, we generated a longitudinal panel data set of key data collected through the AIX. The variables we utilize in our analyses are described in Table A1. Each of these variables is reported annually for each state park system between the years 1984 and 2013[8].

Modifications to Original Data

Missing Data – Due to poor data collection standards or limited resource available to those responsible for the AIX archive in the past, not all state park systems reported their data for each year. Consequently, the longitudinal panel data set has several missing data points (Table A2).

[8] The AIX archive contains data back to 1979. However, poor data collection and/or archiving standards for data prior to 1984 prohibit their use.

Table A1. Variables from the AIX archive used to construct the longitudinal panel data set (1984 – 2013)

Variable	Definition	Location in annual AIX Excel spreadsheets
Attendance	The total counts of day and overnight visitation to both fee and non-fee areas.	Table 3 – L3:L53
Operating Expenditures	Payments made for goods and services to manage a state park system. Operating expenditures are funded through park generated revenue, general funds, dedicated funds, federal funds, and other funds such as interagency transfers and money generated through temporary leases.	Table 5 – G3:G53
Capital Expenditures	Non-recurring expenditures used to improve the productive capacity of a state park system. Typically, these are for land acquisition, periodic park improvements, and construction. Capital expenditures are funded through park-generated revenue, state appropriations, dedicated funds, bonds, federal funds, and other sources such as gifts, grants, and transfers.	Table 5 – Q3:Q53
Revenue	Monies generated from use fees and charges; this includes all revenue from ‘entrance fees’, ‘camping fees’, ‘cabin/cottage rentals’, ‘lodge rentals’, ‘group facility rentals’, ‘restaurants’, ‘concessions’, ‘beaches/pools’, ‘golf courses’, and ‘other’ sources such as donations.	Table 5 – DA3:DA53
Labor	The total count of full-time, part-time, and seasonal employees who maintain, operate, and protect a state park system.	Table 6 – U3:U53
Acreage	The total acreage within each state park system; this includes ‘parks’, ‘recreation areas’, ‘natural areas’, ‘historical areas’, ‘environmental education areas’, ‘scientific areas’, ‘forests’, ‘fish and wildlife areas’, and ‘other miscellaneous areas’.	Table 1 – AN3:AN52

Table A2. Missing data in the longitudinal panel data set (1984 – 2013)

Variable	Missing Data Points	Percent Missing
Attendance	15	1.00
Operating Expenditures	8	0.53
Capital Expenditures	53	3.53
Revenue	10	0.67
Labor	3	0.20
Acreage	9	0.60

Given only a small proportion of the data were missing, we used linear interpolation to fill missing values. For each panel (state), we generated interpolated missing values as a function of time (year)[9].

Inflation – We adjusted all monetary variables (operating expenditures, capital expenditures and revenue) to a 2013 base rate to compensate for inflation. The adjustments were made using the Consumer Price Index for all Urban Households (www.bls.gov).

Aggregation – To complete the trend analysis for all state park systems, we collapsed the data by year across all states[10].

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[9] In the Stata statistical software package, this was completed using the ipolate command. For example, `by stateid: ipolate attendance year, gen(iattendence)`. We interpolated each of the variables listed in Table A1; the new variables have the `i` prefix.

[10] For example, the Stata code was: `by year, sort: egen sum_iattendance = total(iattendance)`. We summed for each of the variables listed in Table A1 and then dropped all duplicates (1,470 observations) using the code:

```
drop stateid state iattendance ioperating icapital irevenue ilabor iacres
sort year sum_iatt sum_iope sum_icap sum_irev sum_ilab sum_iacr
quietly by year sum_iatt sum_iope sum_icap sum_irev sum_ilab sum_iacr: gen dup =
cond(_N==1,0,_n)
drop if dup>1
drop dup
/*Save the datafile as aix_ts_collapsed.dta*/
```

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