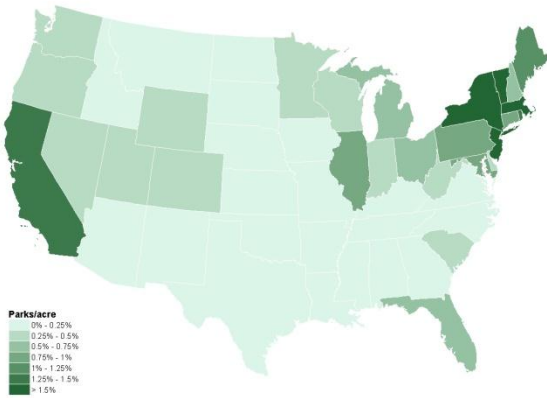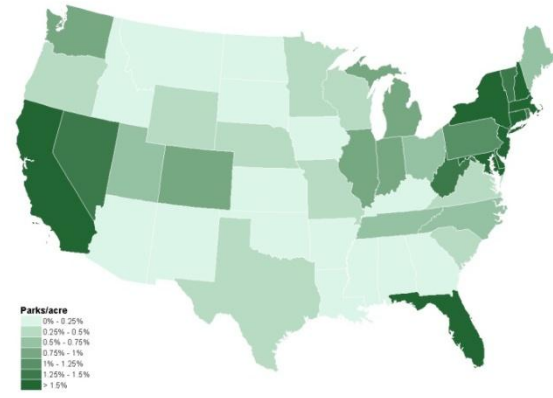**Supporting Information: Table of Contents**

1. **Fig. SI-1. State Parks per Acre in 1975 and 2007, and Change in Parks per Acre per Capita Variable in 1975–1993, 1993–2003, 2003–2007, and 1975–2007**

SI-1.1. State Parks per Acre in 1975

SI-1.2 State Parks per Acre in 2007
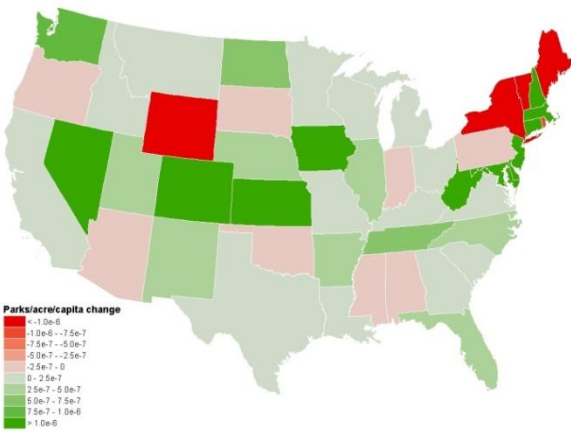
SI-1.3 State Parks per Acre per Capita, Change in 1975–1993

SI-1.4 State Parks per Acre per Capita, Change in 1993–2003

SI-1. 5 State Parks per Acre per Capita, Change in 2003–2007

SI-1.6 State Parks per Acre per Capita, Change in 1975–2003

2. Table SI-1: Final Estimation Results, Including Variable Descriptions

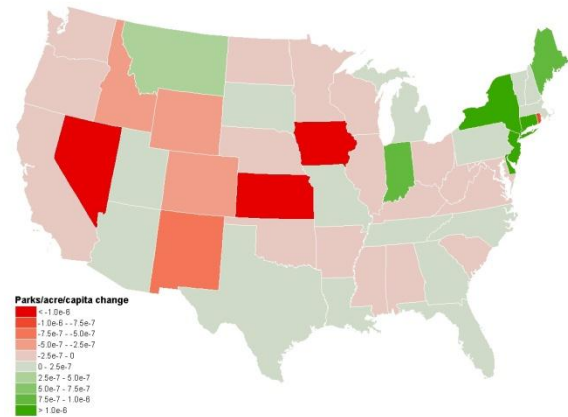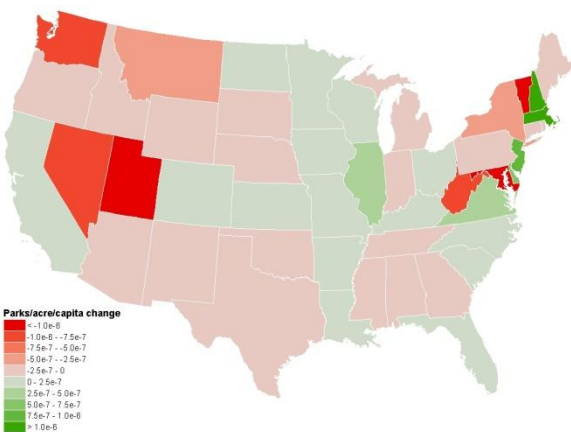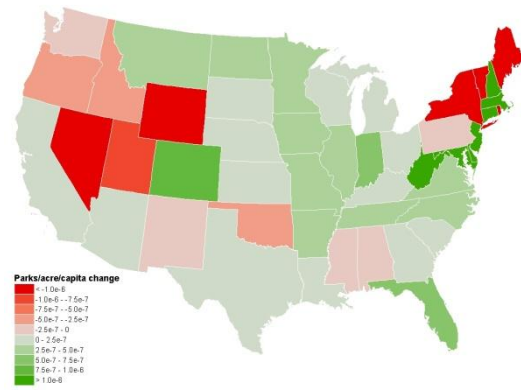| Variable	Description	Estimate	*t*-value	*p*-value
State Parks	State parks, acres per total land per 100,000 people	1.9713	2.070	0.044
Out-of-State State Parks	Out-of-state state parks (similar measure to above) within 150-mile radius of the population weighted state-centroid	0.8188	0.240	0.808
Federal Lands	Federally owned land, acres per total land per 100,000 people	-0.0038	-0.610	0.544
Age_group2	% population 30–40 years old	1.0719	0.260	0.793
Age_group3	% population 40–50 years old	-6.4787	-1.760	0.085
Age_group4	% population 50–60 years old	-1.7378	-0.390	0.697
Age_group5	% population over 60 years old	-6.2114	-1.150	0.257
Educ2	% population, high school education	-4.1063	-1.910	0.064
Educ3	% population, some college education	-2.9907	-0.770	0.446
Educ4	% population, college education or more	-2.1916	-0.800	0.426
Working	% population working full-time	5.1898	0.700	0.490
Working_Part	% population working part-time	-3.2188	-0.770	0.444
Student	% population student	8.0239	0.520	0.603
Unemployed	% population unemployed	3.8143	0.280	0.779
Homemaker	% population homemaker	3.9924	0.510	0.612
Retired	% population retired	8.5696	1.210	0.235
Black	% population black	0.6787	0.230	0.823
Leisure	Leisure, hours per person per week	0.1106	2.230	0.031
Year	Calendar year	0.0518	1.000	0.324
Constant	Estimation constant	-108.37	-1.040	0.303

Notes: Estimated using Full Panel 1975–2007, panel regression model with state effects, fixed effects for the 1993 survey and the 2003/2007 ATUS survey, and robust standard errors clustered at the state level. Dependent variable is the amount of nature recreation (hours per person per week), on average, by state.

3. **Table SI-2: Robustness Checks Using Alternative Estimations: Estimated Coefficient for the Parks Density Per Capita Variable, by Estimation Data Set and Estimation Method**

Estimation method	Estimation data set[a]	Coefficient	t-value[b]	p-value	Observations
1. Panel fixed effects censored regression	Full panel 1975–2007	2.423	2.44	0.02	163
	Full panel 1975–2003	3.579	3.32	0.00	120
	Balanced panel 1975–2007	2.183	1.96	0.05	136
	Balanced panel 1975–2003	2.927	2.63	0.00	102
2. Panel first-differenced estimation equation	Full panel 1975–2007	1.648	1.84	0.07	120
	Full panel 1975–2003	2.873	3.32	0.00	77
	Balanced panel 1975–2007	2.197	2.40	0.02	102
	Balanced panel 1975–2003	2.395	1.96	0.05	68
3. Panel fixed effects, out-of-state parks measured by average parks density of neighboring states	Full panel 75-07	1.785	1.88	0.07	178
	Full panel 75-03	3.051	3.11	0.00	131
	Balanced panel 75-07	1.845	1.60	0.12	148
	Balanced panel 75-03	2.798	2.00	0.05	111
4. Panel fixed effects (main model), using region-specific time trends[c]	Full panel 75-07	1.939	1.83	0.08	163
	Full panel 75-03	2.870	2.59	0.01	120
	Balanced panel 75-07	1.792	1.57	0.13	136
	Balanced panel 75-03	2.526	1.62	0.12	102

[a] Full panel comprises 47 states (all lower 48 states except New Hampshire, which is excluded because of missing data); balanced panel comprises 37 states for which no data are missing for any of the years 1975, 1993, 2003, and 2007.

[b] Robust standard errors clustered at the state level.

[c] Each of the four US Census regions (Northeast, Midwest, South, West) is estimated a separate time trend of nature recreation.

4. Table SI-3: Data for Figures 2–3

Year	Figure 2. Percentage of Population with Nonzero Time Use on the Interview Day			Figure 3. Nature Recreation, Time Use Per Capita (hr/wk)		
	Average	Low-95	High-95	Average	Low-95	High-95
1975	4.64%	3.79%	5.48%	0.791	0.579	1.003
1985	3.08%	2.60%	3.56%	0.594	0.474	0.714
1993	2.20%	1.89%	2.52%	0.574	0.469	0.679
2003	2.38%	2.16%	2.60%	0.484	0.423	0.546
2007	2.65%	2.35%	2.95%	0.511	0.427	0.594

5. Time Use Surveys and Constructing a Consistent Measure of Nature Recreation over Time

Time Use Survey Data

Data on time use for nature recreation in this study come from five time use surveys conducted between 1975 and 2007. Each survey was designed to be a nationally representative and methodologically rigorous time-use survey. The first two surveys (1975 and 1985) were conducted by Survey Research at the University of Michigan between October 1975 and November 1976 and January 1985 and December 1985, respectively. The third survey (1993) was conducted between September 1992 and October 1994 by the Survey Research Center at the University of Maryland. The last two surveys (2003 and 2007) are part of the American Time Use Survey (ATUS). ATUS is sponsored by the U.S. Bureau of Labor Statistics and has been conducted by the U.S. Census Bureau continuously since 2003. ATUS is one of the official Federal Governments' statistical surveys conducted in accordance with federal guidelines and standards (OMB 2006). ATUS runs continuously and each year's ATUS covers a full calendar year.

Data from the time use surveys conducted in 1975, 1985, and 1993 and the current ATUS by the U.S. BLS were harmonized by AHTUS, the American Heritage Time Use Study (Fisher et al. 2003). Moreover, the different time use surveys used in this study are closely related, and the current ATUS in many ways originates from the time use surveys conducted in 1975, 1985, and 1993 at the Survey Research Centers at University of Michigan and University of Maryland with the help of federal funding (e.g. Shelley 2005).

Time use surveys elicit detailed data on how people distribute their day into different activities. Survey protocols and instruments slightly vary by survey, but each one of them elicits detailed diary of the amount of time people spend doing various activities, such as work, childcare, housework, watching television, volunteering, and socializing, during a 24-hour recall period. Current ATUS collects data on time use diaries by telephone, whereas earlier surveys used mail-surveys with written diaries. Completed diaries provide minute-by-minute recordings of respondent's involvement in different activities. The diaries are then professionally coded into primary, secondary, and even tertiary categories so that each activity is described consistently across different respondents. For example, the ATUS surveys (2003 and 2007) by the Bureau of Labor Statistics (2008) categorize time-use data by using the following 17 primary categories:

1. Personal Care

2. Household Activities

3. Caring For and Helping Household Members

4. Caring For and Helping Nonhousehold Members

5. Working and Work-Related Activities

6. Education

7. Consumer Purchases

8. Professional and Personal Care Services

9. Household Services

10. Government Services and Civic Obligations

11. Eating and Drinking

12. Socializing, Relaxing, and Leisure

13. Sports, Exercise, and Recreation

14. Religious and Spiritual Activities

15. Volunteer Activities

16. Telephone Calls

17. Traveling

Each primary category comprises several second-tier subcategories, which are further divided into third-tier subcategories. As a result, typical time-use survey data list observations

regarding hundreds or thousands of potential activities. When different activities by the same person are added together, they sum up to 1,440 minutes (24 hours). See Shelley (2005) for a description of the development of the current ATUS classification system.

The time use surveys used in this survey were designed to generate data which are representative of the entire U.S. population throughout the year. To achieve this goal, observations on time use were elicited from different people, on different weekdays, and throughout the year. Stratified sampling improves the efficiency of the data collection, but requires the use of weights in generalizing the results to the target population. Therefore, each observation is assigned a population weight so that aggregate predictions can be obtained to accurately reflect the entire population in the US (Fisher et al. 2006). Population weights assign each individual a unique weight that reflects the share of the U.S. population represented by that observation in the year of the survey. Additionally, day weights are needed in some surveys to control for the sometimes uneven sampling of different weekdays. For example, in the ATUS survey (2003 and 2007) by the U.S. Bureau of Labor Statistics, half of the ATUS sample is elicited data on time use on weekend days (Saturday and Sunday) whereas the other half is collected data regarding weekdays. Weekend and weekdays generally have distinct time use patterns and the stratified sampling between weekends and weekdays enables collecting rich data on both weekdays and weekends. Because of stratification, day weights are necessary for obtaining accurate aggregate estimates of time use during a specific time periods, such as a survey year. Similarly, population weights enable aggregating estimates to accurately predict time use in the entire U.S. population. A combined weight can be calculated from the population and day weights to assign each observation an overall weight in the predictions.

Full descriptions of different surveys and their coding manuals are available in the reports by the American Heritage Time Use Study (Fisher et al. 2003) and the documentation of the ATUS by the Bureau of Labor Statistics (2008). In addition, the AHTUS website at http://www.timeuse.org/ahtus provides further information on time use surveys in this study. ATUS website by the BLS at http://www.bls.gov/tus/ provides an overview and full documentation of ATUS, including summary statistics, tables, answers to frequently asked questions, and access to data.

Because extensive documentation on both ATUS and AHTUS data are readily available from their primary sources, it is not practical to explain each survey in great detail here. Instead, we focus next on describing the construction of our key variable: time use for nature recreation.

Constructing a Consistent Measure of Nature Recreation over Time

Construction a consistent measure of time use for nature recreation over time requires identifying one or more recorded time use categories under which all nature recreation and no activities other than nature recreation were classified by different surveys. This study draws from the original coding manuals and other material describing each survey to determine how time use for nature recreation can be consistently tracked over time. "Nature recreation" in this study represents the most precise yet over time consistent measure of the popularity of nature recreation, which can be compiled from the currently available time use data between 1975 and 2007.

Table SI-6 explains the original variables from each study used for measuring time use for nature recreation. The table includes the variable code in the original survey data file as well as examples of variable descriptions from the original coding books. The examples of activities

included in the variable are not exclusive, but list possible descriptions by respondents which were meant to assist survey professionals to accurately code time use data from individual diaries.

The 1975 survey included a range of activity categories classified under the variable "out of doors," including hunting, fishing, boating, sailing, canoeing, camping, snowmobiling, picnicking, and excursions. AHTUS data aggregates these variables into variable originally coded as V1162, which is used in this study. The 1985 and 1993 surveys used nearly similar categorizations which classify nature recreation activities as "outdoor recreation" (variable originally coded as ACT81 in both surveys).

Table SI-6

Time-use categories related to nature recreation, by survey

Year	Variable code in AHTUS/ATUS data files	Variable description, examples of activities included, extracted directly from the codebook
1975	V1162	Variable "Out of Doors," including hunting, fishing, boating, sailing, canoeing, camping, snowmobiling, picnicking, excursions
1985	ACT81	Variable "ACT81" outdoor recreation, including fishing, hiking, hunting, boating, camping, walking
1993	ACT81	Variable "Outdoor recreation"
2003, 2007	Tier 1 code = 13 & Tier 2 code = 1 & Tier 3 code 6,8,12,16, 18, 25,or 32	Activities falling under Tier 1 "Active sports," Tier 2 "Participating in sports, exercise, and recreation," and the following Tier 3 categories: Boating (tier 3 code = 6), climbing, caving, spelunking (tier 3 code =8), fishing (tier 3 code = 12), hiking (tier 3 code = 16), hunting (tier 3 code 18 skiing, snowboarding (tier 3 code =25), and water sports (tier 3 code = 32)

The 2003 and 2007 ATUS surveys by the BLS are detailed in the categorization of different activities, as explained above. Of the 17 primary categories of ATUS, we concentrate on activities in category 13: Sports, Exercise, and Recreation. Under that category, time use is further classified into several second-tier subcategories, including both physically active and physically inactive forms of recreation. We focus solely on the physically active forms of recreation (under Tier 2 category 2) and exclude activities such as attending sports events as a spectator. The physically active forms of recreation are further classified in ATUS into 37 more specific third-tier categories. These categories include activities such as playing baseball, playing basketball, biking, boating, bowling, climbing, dancing, equestrian sports, fishing, football, golfing, hiking, hunting, skiing, walking, and so forth. In this analysis, we use data on boating (tier 3 code = 6), climbing, caving, spelunking (tier 3 code =8), fishing (tier 3 code = 12), hiking (tier 3 code = 12), skiing, snowboarding (Tier 3 code =25), and water sports (Tier 3 code = 32). Combining these activities into one aggregate variable gives us a measure of time use, which coincides with activities categorized as "nature recreation" from surveys conducted in 1975, 1985, and 1993.

References

Bureau of Labor Statistics (2008) *American Time Use Survey User's Guide: Understanding ATUS 2003 to 2007*. Washington, DC: Bureau of Labor Statistics, U.S. Census Bureau.

Office of Management and Budget (2006), "Standards and Guidelines for Statistical Surveys," Executive Office of the President of the United States, September 2006. http://www.whitehouse.gov/sites/default/files/omb/assets/omb/inforeg/statpolicy/standards_stat_surveys.pdf

Fisher K, M Egerton, N Torres, A Polman, J Gershuny (2006) *American Heritage Time Use Study (AHTUS)*. Essex, UK: Institute for Social and Economic Research.

Shelley, K (2005), Developing the American Time Use Survey Activity Classification System, *Monthly Labor Review,* June 2005: 3-15.

6. **Examining the Potential Endogeneity of the Availability of State Parks as a Regressor**

The potential endogeneity of the availability of state parks as a regressor was examined by inspecting whether the popularity of nature recreation in a state drives the availability of state parks in that state. Multiple models including different variable specifications, their commonly used transformations, and different variable sets as predictors were used in these assessments. First, the availability of state parks, denoted by h below, was predicted by the popularity of nature recreation (nature recreation per capita per year, denoted by x below) in the previous time period following the general model below:

$$h_{it} = x_{it-1}\beta + Z_{it}\beta_z + \alpha_i + \gamma t + \delta_t + \varepsilon_{it}.$$

(S-1)

The variable Z includes other independent variables in addition to the popularity of nature recreation, such as demographics and the availability of federal lands and state parks in the neighboring states. The model specification also allows for state fixed effects (α_i), time trend (γ), and annual fixed effects (δ_t).

A large number of possible specifications were examined for robustness. The simplest specification included only a constant and nature recreation per capita as independent variables; the richest models included all possible independent variables. The assessment examined three different measures of the availability of state parks (acres of state parks per acre of land per capita; acres of state parks per acre of land; acres of state parks per capita; see below) and five different model specifications. Different model specifications started from a model with only a constant and the variable "Nature Recreation per Capita" and gradually increased the richness of the model specification so that the final specification included all the available independent

variables and state fixed effects. None of the 30 estimated models suggested that the popularity

of nature recreation in the previous period affects the availability of state parks in the next period

(the p-value of the estimated coefficient is, on average, 0.69). See Table SI-4 for the estimation

results.

Supporting Information Table SI-4

Estimated coefficients of the variable "Nature Recreation per Capita" (NRPC) when predicting
the availability of state parks in the next period, by three alternative measures of the availability
of state parks (parks per acre per capita, parks per acre, parks per capita; log-transformed and
absolute) and five different model specifications. P-values are listed in parenthesis.

	Dependent Variable					
	Parks per Acre Per Capita		Parks per Acre		Parks Per Capita	
Specification (variables included)	Absolute	Ln	Absolute	Ln	Absolute	Ln
1. NRPC + constant + random effects	-.00046 (0.905)	-.01143 (0.637)	-.00028 (0.261)	-.02316 (0.382)	-59.236 (0.692)	-.00936 (0.713)
2. NRPC + constant + state fixed effects	.00080 (0.828)	-.00190 (0.933)	-.00010 (0.675)	-.00798 (0.749)	-30.891 (0.813)	-.00190 (0.933)
3. NRPC + constant + trend + state fixed effects	.00088 (0.838)	-.00184 (0.943)	.00008 (0.756)	.0016 (0.951)	-44.323 (0.773)	-.00184 (0.943)
4. NRPC + constant + trend + demographics + state fixed effects	.00881 (0.389)	.02561 (0.564)	-.00008 (0.906)	.02591 (0.574)	166.12 (0.520)	.02561 (0.564)
5. NRPC + constant + trend + demographics + federal lands + state fixed effects	. 0.0096 (0.361)	0.0262 (0.557)	-0.0001 (0.908)	0.0298 (0.540)	169.33 (0.506)	0.02924 (0.520)

The potential endogeneity of the availability of state parks was further examined by assessing whether changes in the availability of state parks within a time period (for example, 1993-2003) was influenced by the recent popularity trend of nature recreation in the state. The estimation model is now structured as follows:

$$\Delta h_{it,it-1} = \Delta x_{it-1,it-2}\beta + Z_{it}\beta_z + \alpha_i + \gamma t + \delta_t + \varepsilon_{it},$$

(S-2)

where variable definitions are as in the equation (S-1) above. Again, the models examined three different measures of the availability of state parks, their transformed and untransformed values, and five different model specifications.

None of the estimated 30 models suggested that changes in the availability of state parks are driven by changes in the popularity of nature recreation in the previous period. See Table SI-5 (next page) for the estimation results. The p-value of the estimated coefficient is, on average, 0.55.

Supporting Information Table SI-5

Estimated coefficients for the variable change in the "Nature Recreation per Capita" (NRPC) when predicting the *change* in the availability of state parks in the next period, by three alternative measures of the availability of state parks (parks per acre per capita, parks per acre, parks per capita; log-transformed and absolute) and five different model specifications. P-values are listed in parenthesis.

	Dependent Variable					
	Parks per Acre Per Capita		Parks per Acre		Parks Per Capita	
Specification	Absolute	Log	Absolute	Log	Absolute	Log
1. NRPC + constant + random effects	0.0018	0.0119	0.0001	0.0150	16.58	0.0119
	(0.600)	(0.578)	(0.458)	(0.510)	(0.897)	(0.578)
2. NRPC + constant + state fixed effects	0.0026	0.0261	0.0002	0.0308	82.83	0.0261
	(0.487)	(0.350)	(0.401)	(0.298)	(0.509)	(0.350)
3. NRPC + constant + trend + state fixed effects	0.0013	0.0243	-0.0001	0.0217	92.46	0.0243
	(0.688)	(0.342)	(0.849)	(0.415)	(0.400)	(0.342)
4. NRPC + constant + trend + demographics + state fixed effects	-0.0188	-0.0220	-0.0010	-0.0197	-509.71	-0.0220
	(0.253)	(0.814)	(0.475)	(0.838)	(0.228)	(0.814)
5. NRPC + constant + trend + demographics + federal lands + state fixed effects	-0.0141	0.0015	-0.0010	-0.0197	-318.06	0.0105
	(0.361)	(0.987)	(0.475)	(0.838)	(0.404)	(0.909)

7. Replicating Estimations Using State-level Estimation Dataset

The dataset and programs in this SI section enable reproducing the statistical estimation results in the manuscript without having to reproduce the main estimation data set (described in SI-8). The submitted Excel-file also replicates policy assessment results in the Table 2 of the manuscript: nature recreation services contributed by (i) the U.S. state parks expansion between 1975 and 2007 and (ii) the entire U.S. State Park system.

Data file

The file "Measuring Nature Recreation Services.xls" is an Excel spreadsheet with three worksheets explained below. It accompanies the manuscript and is also available from the author.

Table SI-7. Description of file "Measuring Nature Recreation Services.xls"

Worksheet	Description
"1. Estimation Dataset"	Dataset which includes all variables and data to reproduce the statistical estimation results in Table 1 and robustness checks in SI-2. See below for descriptions of Stata commands required in the replication of estimation results.
"2. Variable descriptions"	Descriptions of the variables in worksheet "1. Estimation Dataset."
"3. Table 2 Policy Assessment"	Policy assessments reported in Table 2 of the manuscript: Nature recreation services contributed by (i) the U.S. state parks expansion between 1975 and 2007 and (ii) the entire U.S. State Park system.

Stata code

Using State to reproduce estimation results in Table 1 of the manuscript results, first save the "Estimation Dataset" worksheet as a comma separated file ("Data.csv"). Then, follow the steps:

*Load data (specify correct file directory in the "filedirectory" below)

insheet using "filedirectory\ Data.csv", comma

*Declare panel and year variables:

xtset fips year_int

*Create a global variables to call independent variables in the routine

```
global demogr age_group2 age_group3 age_group4 age_group5 educ2 educ3 educ4
working work_part student unemp homemaker retired black leisure ATUS
```

*Run the fixed effect model using full panel 1975-2007:

```
xtreg ln_nature_rec parks_per_acre_per_capita parks_outstate_150
fedlands_per_acre_per_capita $demogr year_actual d93, fe vce(cluster fips)
```

*Run the fixed effect model using full panel 1975-2003:

```
xtreg ln_nature_rec parks_per_acre_per_capita parks_outstate_150
fedlands_per_acre_per_capita $demogr year_actual d93, fe vce(cluster fips)
```

*Run the fixed effect model using balanced panel 1975-2007:

```
xtreg ln_nature_rec parks_per_acre_per_capita parks_outstate_150
fedlands_per_acre_per_capita $demogr year_actual d93, fe vce(cluster fips)
```

*Run the fixed effect model using balanced panel 1975-2003:

```
xtreg ln_nature_rec parks_per_acre_per_capita parks_outstate_150
fedlands_per_acre_per_capita $demogr year_actual d93, fe vce(cluster fips)
```

*Difference estimation equation, example using full panel 1975-2003:

```
xtreg D.(ln_nature_rec parks_per_acre_per_capita parks_outstate_150
fedlands_per_acre_per_capita $demogr year_actual d93) if full_panel_75_03==1,
vce(cluster fips)
```

*Censored regression fixed effects model, example using full panel 1975-2003:

```
xi: xttobit ln_nature_rec parks_per_acre_per_capita parks_outstate_150
fedlands_per_acre_per_capita $demogr year_actual d93 i.fips) if
full_panel_75_03==1, ll(-4.60)
```

8. Constructing the Estimation Dataset from Original Data Files

The estimation dataset in the section SI-7 above combines information from altogether 13 original data files. Eleven of these files are publicly available time use survey data and two are data files constructed from publicly available information for the purposes of this study. The original data files are described below.

1. timeuse_75.dta (the original 1975 AHTUS microfile, available at request at http://www.timeuse.org/ahtus)

2. timeuse_85.dta (the original 1985 AHTUS microfile, available at request at http://www.timeuse.org/ahtus)\

3. timeuse_93.dta (the original 1993 AHTUS microfile, available at request at http://www.timeuse.org/ahtus)

4. atuscps_2003 (the original 2003 ATUS microfile, ATUS CPS file, download at ftp://ftp.bls.gov/pub/special.requests/tus/atuscsp_2003.zip)

5. atusrost_2003 (the original 2003 ATUS microfile, ATUS roster file, download at ftp://ftp.bls.gov/pub/special.requests/tus/atusrost_2003.zip)

6. atusresp_2003 (the original 2003 ATUS microfile, ATUS respondent file, download at ftp://ftp.bls.gov/pub/special.requests/tus/atusresp_2003.zip)

7. atusact_2003 (the original 2003 ATUS microfile, ATUS activity file, download at ftp://ftp.bls.gov/pub/special.requests/tus/atusact_2003.zip)

8. atuscps_2007 (the original 2007 ATUS microfile, ATUS CPS file, download at ftp://ftp.bls.gov/pub/special.requests/tus/atuscsp_2007.zip)

9. atusrost_2007 (the original 2007 ATUS microfile, ATUS roster file, download at ftp://ftp.bls.gov/pub/special.requests/tus/atusrost_2007.zip)

10. atusresp_2007 (the original 2007 ATUS microfile, ATUS respondent file, download at ftp://ftp.bls.gov/pub/special.requests/tus/atusresp_2007.zip)

11. atusact_2007 (the original 2007 ATUS microfile, ATUS activity file, download at ftp://ftp.bls.gov/pub/special.requests/tus/atusact_2007.zip)

12. state_parks_PNAS.dta (constructed in this study; request from the author)

13. neigborparks.dta (constructed in this study; request from the author)

A Stata program is available from the author to compile the estimation dataset and to reproduce the statistical estimation results in the main body of text and SI, starting from the original time use survey data files (1-11 above) and data on state level variables (12 & 13 above). Some of the data files comprise a large number of variables, which may necessitate using a Stata SE version.