Recreation travelers' carbon footprint

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Outdoor recreation on public lands provides many benefits. Spending by visitors in communities near the recreation site provides regional economic benefits by supporting and sustaining jobs. There are also many non-market benefits. Personal benefits include improved health, greater connection to nature, reduced stress, and better quality of life. Social benefits can include strengthening family ties and improved stewardship ethics. Valuation of these non-market benefits has typically come through the Travel Cost Method (TCM), a technique which uses out-of-pocket and time costs for travel to the recreation site to estimate the value of access to the site.

One aspect of recreation travel that has thus far been ignored is its carbon footprint. Carbon emissions from recreation travel are externalities, created by households in the production of recreation trips. We posit that the value of the carbon should be offset against the values generated under a traditional TCM approach. In this paper, we use data from the Forest Service's National Visitor Use Monitoring program to examine the size and value of the carbon created by visitation to the US National Forest System. We evaluate the carbon footprint of several different types of visits, and calculate an overall estimate of the carbon generated by the roughly 170 million annual visits to National Forests and Grasslands.

Data and computations

Data for this analysis came from the Forest Service's National Visitor Use Monitoring (NVUM) program. We used the individual recreation responses for the most recent NVUM application on each National Forest, which spanned the period 2007–2011.

For some portion of NF visits, recreating on the forest is not the main reason for taking the trip from home. Rather, it is a side trip. To value a visit to such a secondary destination, a standard approach is to assume a minimal value for the marginal spending or non-market value created by the side trip. We divided the sample into three groups: local residents (travel distance <= 50 miles) whose primary destination was the National Forest visited, non-local residents whose primary destination was the National Forest visited, and those whose primary destination was somewhere else. For the last group, we assumed their marginal travel was the same as local residents whose primary destination was the forest. We estimated the number of total visits for each group. Dividing by the mean number of people per vehicle yielded vehicle visits.

Respondents provided travel distances from home to the recreation site. We assumed that for most visits, the key transportation mode was by car. US EPA provides an average mile per gallon (20.4) and metric tons of CO2 per gallon (0.00892) conversion (http://www.epa.gov/cleanenergy/energy-resources/refs.html). A small portion of the Non-local primary visitors reported round-trip distances in excess of 5,000 miles. We assumed that these trips were mostly by airplane and not by car. US EPA provides conversion from passenger-miles to CO2 (0.000193 metric tons per passenger mile for long haul trips (http://www.epa.gov/climateleadership/smallbiz/footprint.html).

Carbon emissions and social costs

Carbon computations were straightforward (Table 1). Carbon from cars equaled (vehicle visits)*(mean car miles per vehicle visit)*(1 gallon/20.4 car miles)*(0.00892 metric tons CO2 / gallon). Carbon from air travel equaled (visits) * (mean air miles per visit) * (0.000193 metric tons CO2 per mile). Total carbon generated by recreation travel to US National Forests is estimated at 9.23 million metric tons. Non-local residents coming primarily to the forests account for about 37 percent of visits, but about 90% of the carbon footprint. Nearly two-thirds of the estimated carbon footprint comes from car travel. Only 2.5% of nonlocal primary flew, but that travel accounts for nearly one-third of total carbon.

Our next step was to calculate the social cost of carbon emissions. US EPA provides guidance (http://www.epa.gov/oms/climate/regulations/scc-tsd.pdf) for monetizing the social cost of carbon. For this analysis we used the middle value for the three models presented, at $21.40 per metric ton in 2010. At this price, carbon created from recreation travel is valued at $197.52 million, or about $1.19 per visit to NFS lands. By comparison, consumer surplus estimates for recreation visits to National Forests are about $61 per visit (in $2010). That is, accounting for the social cost of carbon reduces the net economic value of recreation by a little less than 2 percent. Although the carbon costs are nontrivial, it appears that not including them does not lead to gross overestimates of the value of recreation on National Forest lands.

Several additional analyses could refine our results. We assumed a national average for miles per gallon. Driving to and into National Forests may yield fuel efficiencies different from national averages. Regional differences in road conditions, travel speeds, transporting recreational equipment, and vehicles used could have important impacts. We assumed no relationship between distance traveled and persons per vehicle. It could be that people amortize the costs of longer travel by increasing party size. Our assumption for air travel for non locals visits traveling more than 2500 miles one way was fairly naïve, but we lacked more accurate data for air travel. Our analyses only concern travel to the Forest, not activity-related travel once there.

Table 1. Carbon footprint calculations for visits to the National Forest System, 2011

	VISIT TYPE (residence and if NF is primary destination)			
	Local residents, NF is primary destination	Non-local residents, NF is primary destination	NF is Secondary Destination	National Total
NF Visits (millions)	82.55	61.98	21.16	165.69
Mean people per vehicle	2.21	3.10	2.93	
Vehicle Visits (millions)	37.34	19.99	7.22	64.55
Mean roundtrip car miles per visit	37.55	587.70	37.55	
Total Car miles (millions)	1,401.9	11,749.8	272.8	13,424.5
CO2 from car travel (millions of metric tons)	**0.62**	**5.14**	**0.12**	**5.88**
Mean roundtrip air miles per visit	0	280.3	0	
Total Air miles (millions)	0	17,373.0	0	17,373
CO2 from air travel (millions of metric tons)	**0**	**3.35**	**0**	**3.35**
TOTAL CO2 (millions of metric tons)	**0.62**	**8.49**	**0.12**	**9.23**