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Structure and Properties of a Wilderness Travel Simulator: An Application to the Spanish Peaks Area

by V. Kerry Smith and John V. Krutilla
Baltimore and London, Johns Hopkins University Press for
Resources for the Future, 1976, pp. xi + 173.
46 tables, map, references, no index.

Recently, reflecting on three short but highly satisfactory hikes in Norway and Scotland, I realized that much enjoyment stemmed from a nice balance: we had managed to visit pretty well-known peaks and plateaus while yet feeling that we had “kept off the beaten track.” In all three cases our trails were marked on the ground and published in maps; perhaps thousands of walkers had preceded us. Yet we met hardly anyone. And therein lay our pleasure. If we had been forced into line like pilgrims on Fujiyama, miners on the Trail of '98 at Skagway, or down-hill skiers waiting for a lift, our pleasure would have been much less.

Starting with ordinary experiences like this, Smith and Krutilla lead the reader along the following chain of reasoning. Imagine our job were to decide which of many similar areas were to be permanently dedicated as a wilderness area. To do this we must be able to judge when such areas are yielding as many benefits—enjoyable visits—as possible. Assume that we are to accept the opinion of visitors and users about the benefits to be derived from an area. Experiences such as mine in Europe suggest a paradox: because the more beautiful and accessible an area, the more it will be visited, the more congested the trails and campsites, and the more unsuccessful the quest for privacy, the *lower* the valuation placed on the area by those whose opinion is sought. Such an area might be a good candidate for a playground or a suburb, but not as a reserve or wilderness. Yet a little consideration suggests that if encounters could be reduced, spaced out, or perhaps concentrated at certain times or places, visitor's evaluation of the area as a wilderness would rise. That is, evaluation and selection of areas are dependent on how they are “managed.” If the managers of an area employed such measures as re-locating trails to prevent encounters or even sightings, established fixed entry and exit points, starting times, and so on, the “maximum wilderness benefit” of which the area is capable could be estimated. This amount, measured in a common unit such as dollars, could then be compared with the maximum benefit from alternative, conflicting land uses of the same area.

To do all this, several collaborators from Resources for the Future have launched a two-stage procedure. First, potential users of an area must give the investigators a dollar evaluation of each area under *specific conditions of congestion*. From this would come a schedule of amounts typical users would be "willing to pay" for visits of particular durations and degrees of congestion. A few such studies already have been made by various authors. In a companion volume, Smith and C. J. Cicchetti describe their own success in obtaining direct willingness-to-pay estimates for the Spanish Peaks area. It might be described as the "demand" or benefit stage. In the present volume, Krutilla and Smith initiate "supply" or management-simulation studies in the light of which the Spanish Peaks area ultimately might be managed to maximize the enjoyments of its wilderness visitors. A final chapter sketches the linking of the results of the two complementary volumes.

The authors do not actually manage the Spanish Peaks area, nor do they attempt directly to measure all benefits of reducing different levels of congestion. Instead they assemble from sample data the typical dates, routes and periods in the area of parties of different sizes. Then all possible segments of trails were coded according to a condensed numbering system: route number 1, for instance, consists of four segments. It crosses or joins three other routes, creating the possibilities not only of passing and overtaking on itself, but also intercepting other parties three times. Thus, for route 1, the total possibility of an encounter between two groups depends on the number of parties on it, their direction, their relative speeds, the number of junctions with other routes, and similar characteristics of those on intersecting routes. Smith and Krutilla use their sample, a good map, a computer, and one suspects a lot of personal experience in the area to simulate the "encountering" experiences of 240 hypothetical parties entering the area over a four-week period. For example, about one percent of all parties would be expected to enter on Sunday morning on the fourth week; about three-quarters would walk rather than ride; few parties would be "large"; about one-half would spend one night or longer in the area; and 27 large parties of hikers could expect, among them, to meet about 60 other parties of hikers and riders and to overtake three others. On the average, then, each large hiking party would meet or overtake about three other parties.

This group of 240 parties never existed. Its likely composition, its decisions about routes, and its encounters are all based upon probabilities gleaned from an earlier sample survey. Another run through the computer will give another set of meetings and free periods for another hypothetical group of 240 visitors. The authors typically

publish the average number of encounters to be expected for ten runs of the model, and also the “variance” (the numerical dispersion of predictions between the results of the runs). This is good methodology, to be expected from these authors.

Management is what the book’s work is all about: the point of the cooking is in the eating. In Chapter 5 the authors publish the results of “sensitivity experiments” with their simulation. This is the advantage of simulations: once you believe the basic case, as described above, you can easily change one or two details, then crank out the changed number of encounters to be expected. Three experiments were conducted. The first, rather technical, had to do with the dispersion among visitors of transit times—i.e., the speeds with which they completed their routes: changes in this dispersion turned out to have only a trivial effect on the number of encounters by all the 240 parties. The second and third had more to do with management. In the second, the authors simply “prove” that, even with its large variances between any pair of base simulations, the model does reveal a statistically significant increase in encounters whenever the hypothetical number of visitors is increased above the base 240 parties. In the final test they experimentally implement such management devices as smoothing out weekly or daily peaks of arrival or travel. They show that on average such devices could *significantly* reduce the number of encounters and allow either more enjoyment to the 240 parties or the same enjoyment to more visitors. The book really ends here. The authors do offer to send a manual and the results of more simulations to readers who wish to put the simulations to work on questions about other areas, sensitivity to management rulings, path changes, etc. And there is a large number of well-organized tables, fairly clearly explained, that offer real depth to those who wish to re-read. And a short chapter suggests how the simulation of the “supply” side of wilderness evaluations is married to the Cicchetti-Smith “demand” results for the same area summarized in the companion volume. But separate publication of this simulator model suggests that the authors intend it to stand alone.

I think it will. It will be a welcome “management” tool, both in its present versatile form and in new versions worked out by the hundreds of computer experts now concerned with the congestion to wilderness, national parks, hunting and fishing regions, road networks, marine routes and the like. Just reading the scrupulous text and noting the authors’ refusal to oversell their method does suggest other gains from one-way travel, rationed entry, concealed campsites, and the like. On the other hand, doubts do arise, for further study.

The variances are high: compared to the variances likely to emerge from studies of competing non-wilderness land uses, they are disconcerting. Furthermore, the whole idea of controlled and managed wilderness may turn out to be repellant. Will visitors enjoy spaced and managed tours through the garden of Eden, or will they suffer from the smooth and contrived nature of their freedom from encounters?

Finally, many short-cuts have necessarily been taken to obtain numerical estimates. Some of the results are insensitive to those shortcuts, such as the common-sense finding that much congestion is due to the stereotyped route followed by a relatively large group of one-day hikers. (Indeed, any manager would quickly see, without a simulation, that these busier [or more casual] parties are at the heart of his encounter problem.) But some shortcuts, like the compression of the hundreds of possible alternative routings into just 104 designated trails, may have destroyed the essence of the management-of-wilderness problem, by assuming that the total set of choices open to a party is more limited than visitors perceive it to be.

These possible weaknesses are already apparent to the authors and are pretty thoroughly discussed. A wilderness enthusiast with just one course in economics under his belt can understand much of this book. All concerned with the evaluation and selection of reserved wilderness areas can benefit from it.

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