A sunset carriage ride begins its descent from Day Mountain.

An ocean storm kicks up high surf.

Visitors enjoy big surf.

Sunset along the Cadillac Mountain Summit Road.

Sunrise over Schoodic Point.

Eagle Lake, quiet in the late afternoon.

Acadia's pink granite glows at sunrise.

Sea stack and boulder beach.

Monument Cove.

Bikers above Jordan Pond.

Bikers descending switchbacks on Sargent Mountain carriage road.

The Cobblestone Bridge, one of 17 stone bridges on the carriage-road system.

D. Rockefeller Jr. in the early 1900s, represent one of the most significant resources at Maine's Acadia National Park. Originally built for horse-drawn carriages, the carriage roads are now used primarily for hiking and biking and have become extremely popular. However, increased use has created concern for the quality of the experience on the part of both visitors and managers. In response to this concern, a program of research was initiated to help formulate indicators and standards of quality for the carriage-road experience.

A first phase of research focused on identifying potential indicators of quality. A survey of a representative sample of carriage-road visitors was conducted. Using both open- and close-ended questions, visitors were asked to indicate what added to or detracted from the quality of their experience on the carriage roads. Two types of indicators of quality were identified: one was crowding-related and concerned the number of visitors on the carriage roads; the other was conflict-related and addressed several "problem behaviors" experienced on the carriage roads including bicycles passing from behind without warning, excessive bicycle speed, people obstructing the carriage roads by walking abreast or stopping in groups, and unleashed dogs.

The first phase of research also documented existing patterns of use on the carriage roads and visitor attitudes toward a variety of management alternatives. The carriage roads currently support a diversity of recreation opportunities defined both spatially and temporally. Some areas and times are relatively heavily used while other areas and times accommodate relatively light levels of use. Despite the problem behaviors noted above, most visitors supported maintaining the current mix of carriage-road users — hikers, bikers, and equestrians. Based on these findings, park management decided to maintain a diversity of carriage-road experiences by establishing and defining two types of recreation opportunity "zones" for the carriage roads as defined by location, time of day, and time of year. However, both of these zones would continue to accommodate all types of visitors. The two carriage-road zones would be defined by the same indicators of quality, but different standards of quality would be set.

Crowding-Related Standards of Quality

A second phase of research focused on formulating standards of quality. This research also used a survey of a
representative sample of carriage-road visitors and adopted normative theory and related empirical techniques (Shelby and Heberlein, 1986; Vaske et al., 1986). As applied in outdoor recreation, norms are generally defined as standards that individuals and groups use to evaluate social and environmental conditions in parks and related areas (Shelby and Vaske, 1991). If visitors have normative standards concerning relevant aspects of recreation experiences, then such norms can be studied and used as a basis for formulating standards of quality.

Because of the relatively large number of visitors on the carriage roads, crowding was measured in terms of persons-per-viewscape (PPV), incorporating a visually based measurement approach. The viewscape for the carriage roads (the length of carriage road that can be seen at any one time) averages approximately 100 meters. A series of photographs was prepared that showed a range of zero to 30 visitors on a typical 100-meter section of the carriage roads. The photographs were prepared using a computer and digital photo-editing software. Sample photographs are shown in Figure 1.

Visitors were shown the photographs in random order and asked to rate their acceptability on a scale from minus 4 (very unacceptable) to plus 4 (very acceptable). Study findings are shown in Figure 2. This figure is called a norm curve and represents the aggregate acceptability ratings for the sample of visitors. The norm curve indicates that visitors generally find that it is acceptable to see up to 14 PPV. However, the quality of the experience is very marginal in the upper portion of this range, and visitors prefer to see far lower PPV levels. A more detailed assessment of PPV was developed through a computer-based simulation model of carriage-road use. This model was developed using the travel routes that visitors reported in the visitor survey. The model can be run at any total daily use level for the carriage roads and estimates the resulting PPV levels that will occur. The model was validated by comparing model estimates to actual carriage-road data.

Using the model, five one-hour trips on the carriage roads were developed and described in a series of scenarios. Incrementally increasing, these trips represented total use levels of 750 to 12,000 visitors. The scenarios described the PPV conditions that would be experienced at each of the five use levels, and visitors were asked to rate the acceptability of each scenario using the scale described above. Once again, a norm curve was developed for these data (Figure 3).

Because the carriage roads are such an important park resource, it was decided that they should be managed to ensure that most visitors enjoy a high-quality experience. Using this management objective, it was decided that at least 80 percent of visitors should have an experience they rate at quality level two or higher on the acceptability scale described above. Data used to develop Figure 3 indicate that these criteria are met at up to a total daily use level of 3,000 visitors. Moreover, data from the computer simulation model indicate that at a total daily use level of 3,000 visitors, a visitor to the more heavily used portions of the carriage roads (high-use zone) would see zero PPV at least 31 minutes out of an hour, one to five PPV no more than 27 minutes out of an hour, six to 10 PPV no more than two minutes out of an hour, and never more than 10 PPV. A visitor to the less heavily used portions of the carriage roads (low-use zone) would see zero PPV at least 48 minutes out of an hour, one to five PPV no more than 11 minutes out of an hour,
The resulting norms were used as a basis of formulating standards of quality. As with crowding-related standards, standards of quality for problem behaviors were set somewhat lower than maximum acceptable norms to ensure a relatively high level of quality. And different standards of quality were set for the high- and low-use portions of the carriage roads to ensure that a diversity of experiences was maintained.

For the high-use portion of the carriage roads, standards of quality specify that visitors should experience no more than two instances of bicycles passing from behind without warning, two instances of excessive bicycle speeds, one instance of visitors obstructing the carriage roads, and no instances of unleashed dogs. For the low-use portion of the carriage roads, these numbers should be one, one, one, and zero, respectively.

**Monitoring and Management**

The carrying-capacity framework described earlier requires that indicators of quality be monitored and that management actions be taken when and where standards of quality are violated. This is an ongoing process on the carriage roads. Crowding-related indicators of quality can be monitored in several ways. Total daily use level of the

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**Figure 1. How Many Is Too Many? Alternative Levels of Use on the Carriage Roads**

**Figure 2. Norm Curve from Photographs.**

![Norm Curve from Photographs](image)

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The research described in this study used relatively sophisticated techniques including digital photographic editing, computer-based simulation modeling, and visitor surveys to help formulate standards of quality. However, these techniques are not always necessary. Moreover, there are other sources of information that can and should be used to help formulate standards of quality including legal and administrative mandates, agency policy, historic precedent, interest-group politics, and expert judgment. Even with an abundance of data, some value judgments are still required from park and recreation managers hoping to formulate standards of quality. But without thoughtful standards of quality, parks are unlikely to realize their full potential to society.

References


carriage roads can be monitored by means of an electronic trail-use counter that has been statistically calibrated to total daily use. PPV levels can be monitored through estimation by the computer-based simulation model of carriage-road use, by a survey of visitors asked to pick the photograph of carriage-road use that looks most like what they experienced, and by observations of PPV levels by trained employees. Conflict-related indicators of quality can be monitored by a survey of visitors and by observations of trained employees.

To date, monitoring has indicated that crowding-related standards of quality have not yet been approached. The current peak total-daily-use level is approximately 2,000 visitors. However, data indicate that existing conditions for some problem behaviors have approached standards of quality. Consequently, park management instituted a number of management actions designed to maintain these standards of quality. These management actions include the development of "rules of the road," which are posted at all carriage-road entrances, a liaison with local biking and hiking groups, and courtesy patrols on the carriage roads. These are the types of management actions that respondents favored in visitor surveys. Recent monitoring indicates that most of the problem behaviors have declined substantially in the past year or two.

**Conclusion**

This study suggests that standards of quality are an important part of park and recreation management. Standards of quality define the type of recreation experience to be provided and maintained and constitute an informed and empirical foundation for subsequent monitoring and management. While the examples described in this study address the quality of the visitor experience, standards of quality can and should address issues of resource quality (Manning et al., 1995; Manning &