

# Indicators and Standards of Quality for Sustainable Recreation/Tourism: Research to Support Management of the Northern Forest

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This study identifies indicators and standards of quality for sustainable recreation/tourism on mountain summits in the Northern Forest, explores tradeoffs among indicators and standards that visitors would prefer to make, and documents recreation/tourism-related impacts on mountain summits.

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<http://www.nsrcforest.org>

# Project Summary

Outdoor recreation/tourism, like other important and growing uses of the Northern Forest, must ultimately be sustainable. This will require thoughtful management that is informed by a strong scientific foundation. Contemporary management and research approaches to sustainability in outdoor recreation/tourism (often called “carrying capacity” in this context) call for formulation of indicators and standards of quality for natural resources and the visitor experience. Indicators of quality are ecological and social variables that can be used to measure sustainability. Standards of quality define the minimum acceptable condition of indicator variables.

This study focused on mountain summits in the Northern Forest as these places are highly valued for both the recreation opportunities they provide and the unique and fragile ecosystems they support. A sample of summits representing a range of recreation opportunities were selected and included in this study: Cadillac Mountain, ME; Camel’s Hump, VT; and Cascade Mountain, NY. Three components of outdoor recreation were explored. First, a visitor survey identified important indicators of quality for the recreation experience and developed standards of quality for selected indicators representing the social, environmental, and managerial dimensions of outdoor recreation. Second, a visitor survey explored the relative value associated with indicators and standards of quality to determine the tradeoffs visitors preferred to make among recreational opportunities. Finally, environmental assessments of summit resources were conducted to determine current land cover conditions and associated impacts of outdoor recreation.

Six indicators of quality for sustainable outdoor recreation/tourism on mountain summits were identified and studied, including 1) number of visitors on trails, 2) number of visitors off trail, 3) environmental impacts on trail, 4) environmental impacts off trail, 5) trail management practices, and 6) management practices designed to keep visitors from walking off trail. Standards of quality for each of these six indicator variables were measured using normative theory and methods and visual simulations, and findings are represented in a series of social norm curves. Stated choice survey and statistical methods were also used to determine the relative importance of indicator variables. Visitors generally preferred low levels of resource impact, low visitor use levels, and little management presence. However, visitors prefer more intensive management practices to ensure that few visitors walked off-trail. The assessment of recreation-related impacts found that impacts are observable at all three study sites, though they are more severe on Cascade Mountain.

Overall, visitors to all three study sites reported experiencing resource, social, and managerial conditions that were better than what they considered to be minimally acceptable, suggesting that they are receiving high quality recreation experiences. Study data can be used to formulate indicators and standards of quality for these and other mountain summits to help ensure that outdoor recreation/tourism opportunities are sustainable into the future.

# Background and Justification

- Importance of mountain summits:
  - Highly valued recreation resources
  - Provide for a wide range of recreation opportunities throughout the Northern Forest
  - Fragile and highly susceptible to impacts resulting from recreational use
- Sustainable outdoor recreation and tourism can be addressed through the concept of *carrying capacity* (Manning, 2007)
  - Carrying capacity is the type and amount of use that can be accommodated while sustaining acceptable resource and social conditions
- The formulation of *indicators* and *standards of quality* is a useful approach to addressing carrying capacity
  - Indicators of quality are manageable, measurable variables that reflect management objectives
  - Standards of quality define the minimum acceptable condition of indicator variables



Camel's Hump, Camel's Hump State Park, VT



# Background and Justification

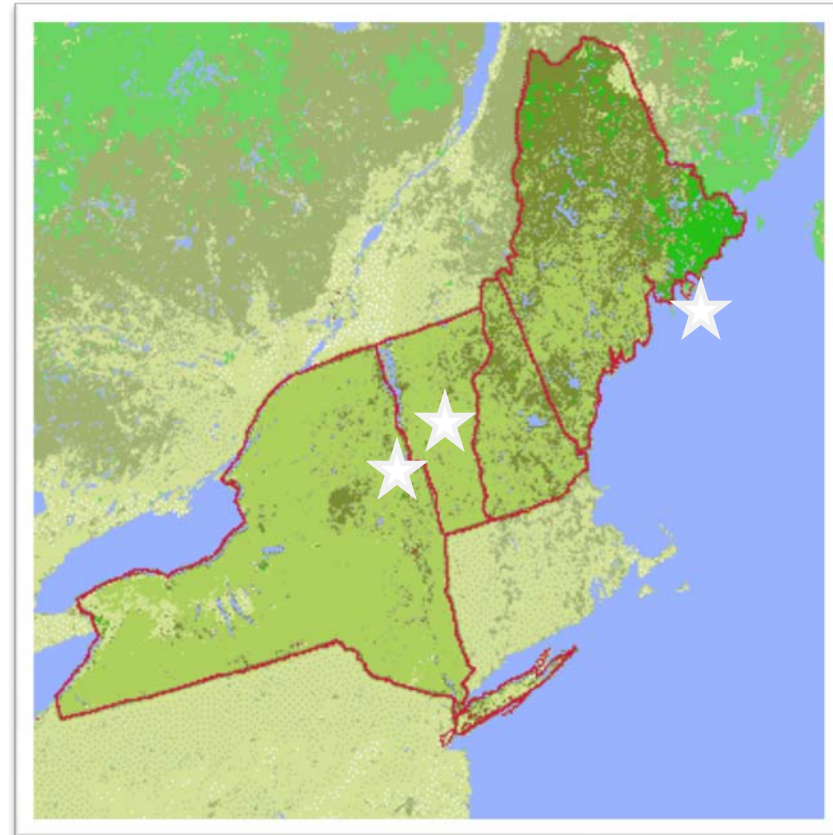
- Tradeoffs are inherent in managing outdoor recreation (Lawson & Manning, 2002)
  - Managers cannot optimize all indicators and standards of quality simultaneously
  - Stated choice modeling is a useful approach to measuring the relative importance of indicators of quality
- Environmental conditions are also an important consideration (Monz, 2000)
  - Environmental conditions influence the visitor experience
  - Mountain summits in particular are important due to their fragile and unique ecosystems, which are under high demand by the public and have important economic and symbolic values
- The Recreation Opportunity Spectrum (ROS) is a useful framework for distinguishing among recreation settings (Clark and Stankey, 1979)
  - The ROS is distinguished by varying conditions, ranging from modern and developed to primitive and undeveloped
  - Recreation opportunity settings are defined by a combination of physical, social, environmental, and managerial conditions
  - Opportunity setting factors include: 1) access, 2) other non-recreational uses, 3) onsite management, 4) social interaction, 5) acceptability of visitor impacts, and 6) acceptable level of regimentation
  - ROS can be adapted to fit most settings in which recreation occurs

# Background and Justification

← Spectrum of Northern Forest Mountain Summits →

Criteria	Type 1 (Primitive)	Type 2	Type 3	Type 4 (Developed)
Access	No trails/visitor created trails only	Low-standard trails	High-standard trails	Roads and high standard trails
Use level	Very low	Low	Moderate	High
Recreational Uses	Bushwhacking/Off-trail hiking	Hiking	Hiking and/or mountain biking	Motorized uses, education/interpretation, hiking/biking
Management Presence	None	Low: some trail maintenance, signs	Moderate: maintained trails, signs, patrols	High: visitor facilities and services, interpreters, management staff
Level of Development	None	Historical/cultural (e.g. fire tower)	Modern - Moderate (e.g. communications tower, old logging road)	Modern - Heavy (e.g. maintenance structures, observatory)

**Mountain summit evaluation matrix based on the ROS**



**Final study sites\*:**

**Cascade, Adirondack State Park, NY**

**Camel's Hump, Camel's Hump State Park, VT**

**Cadillac Mountain, Acadia National Park, ME**

# Methods:

## Identifying Indicators and Standards of Quality

- On-site questionnaire administered to a representative sample of adult visitors at each summit during summer and fall 2008 (n = 476; 82.9% response)
- Analysis of open- and closed-ended questions identified important indicators of quality for the visitor experience
- Normative theory and methods (Vaske and Whittaker, 2004) employed to determine the acceptability of selected social, resource, and management conditions\*
- Questions presented using visual approach (Manning and Freimund, 2004)\*\*
- Variables assessed:
  - Number of people on the trail
  - Number of people off the trail
  - Ecological impacts to trail corridor
  - Ecological impacts to summit area
  - Trail management techniques
  - Management techniques designed to discourage off-trail hiking

Photo 1. 0 people



Photo 1. 9 people



Photo 1. 18 people



Photo 1. 27 people



Photo 1. 36 people



**Example of photographs visitors were asked to evaluate**



# Methods:

## Examining Tradeoffs Among Conditions

- On-site questionnaire administered to a representative sample of adult visitors at each summit during summer and fall 2008 (n = 654; 86% response)
- Stated choice methods incorporated into a visitor survey (Lawson and Manning 2002)
- Survey combined three levels (low, medium, and high) of the six indicator variables mentioned above (see previous slide)
- Fractional factorial orthogonal design method used to combine levels of indicator variables into unique scenarios (Holmes and Adamowicz, 1994)
- 18 choice sets blocked into two surveys
- Visual methods employed to present scenarios (Manning and Freimund 2004)
- Visitors were asked to examine nine sets of paired photographs and indicate which one they preferred

Please look at the two pictures in **Tab 1** of the binder. Which of the conditions represented in these pictures would you prefer to find on this mountain summit?  
(Circle one number.)

Tab 1, Picture A



Tab 1, Picture B



4	3	2	1	1	2	3	4
Strongly prefer picture A		Moderately prefer picture A		Moderately prefer picture B		Strongly prefer picture B	

**Example of study photographs visitors were asked to compare. Respondents used the scale below the photos to indicate their preference.**

# Methods:

## Assessment of Summit Resource Conditions

- Methods used in campsite impact assessment (Hammitt and Cole, 1998) and range management (Booth et al., 2005) were adapted and used on summits
- Entire summit area mapped with high-accuracy GPS
- Sampling grid created in ArcGIS using Hawth's Analysis Tools (Beyer, 2007)
- Overhead digital photograph of 1m<sup>2</sup> plot taken at each grid point
- Digital photos analyzed using SamplePoint\* (Booth et al., 2006)
- Image analysis quantified relative cover of vegetation, lichens, exposed soil, and bare bedrock for each summit
- All visitor-created trails mapped and assigned a condition class:
  - CC1: Trail distinguishable; slight loss of vegetation cover and/or minimal disturbance of organic litter
  - CC2: Trail obvious; vegetation lost and/or organic litter pulverized
  - CC3: Vegetation cover lost and/or organic litter pulverized within the center of the tread; some bare soil exposed
  - CC4: Nearly complete or total loss of vegetation cover and organic litter within the tread; bare soil widespread
  - CC5: Soil erosion obvious; root exposure on trail edges; tread down to bedrock
- Additional vegetation and soil measurements taken for monitoring purposes



**Example of over-head photograph showing various kinds of land cover**





# Results: Indicators and Standards of Quality

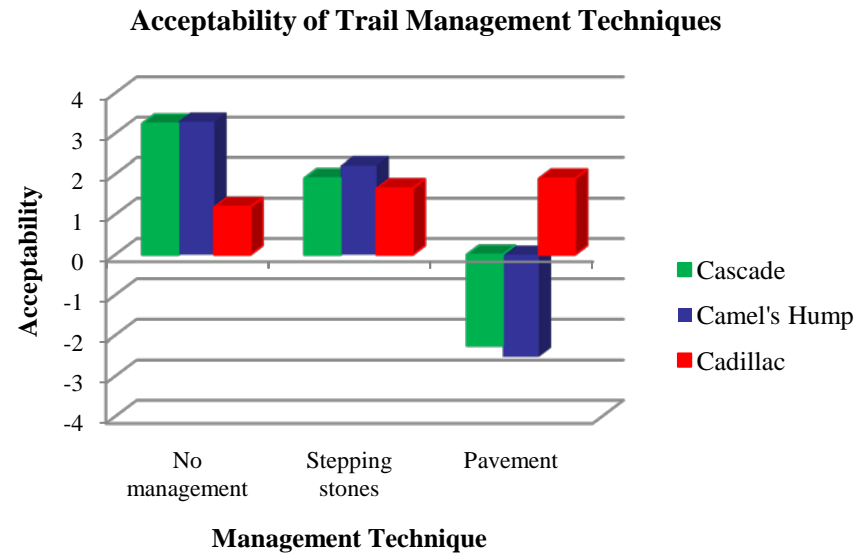
- Indicators of quality:
  - Condition of trails
  - Damage to soil and vegetation along the trails caused by visitors
  - Damage to soil and vegetation caused by visitors walking off of the trail
  - Crowding
  - Parking and traffic issues
  - Summit management techniques (including trail management, signage, interpretive displays, and visitor management)
- Standards of quality: Number of people on the trail
  - Increasing levels of use on the trail become increasingly unacceptable to visitors
  - Maximum number of people considered acceptable:
    - Cascade: 23 PPV\*
    - Camel's Hump: 22 PPV
    - Cadillac Mountain: 28 PPV
  - What visitors typically saw:
    - Cascade: 14 PPV
    - Camel's Hump: 11 PPV
    - Cadillac Mountain: 19 PPV
- Standards of quality: Number of people off the trail
  - Increasing levels of off-trail use become increasingly unacceptable to visitors
  - Maximum number of people considered acceptable:
    - Cascade: 17 PPV
    - Camel's Hump: 15 PPV
    - Cadillac Mountain: 17 PPV
  - What visitors typically saw:
    - Cascade: 11 PPV
    - Camel's Hump: 10 PPV
    - Cadillac Mountain: 14 PPV
- Perceived crowding (1 = “Not at all crowded”; 9 = “Extremely crowded”)
  - Mean perceived crowding levels:
    - Cascade: 4.1
    - Camel's Hump: 4.3
    - Cadillac Mountain: 4.4
  - Visitors at all three summits are feeling “moderately crowded”

# Results: Indicators and Standards of Quality

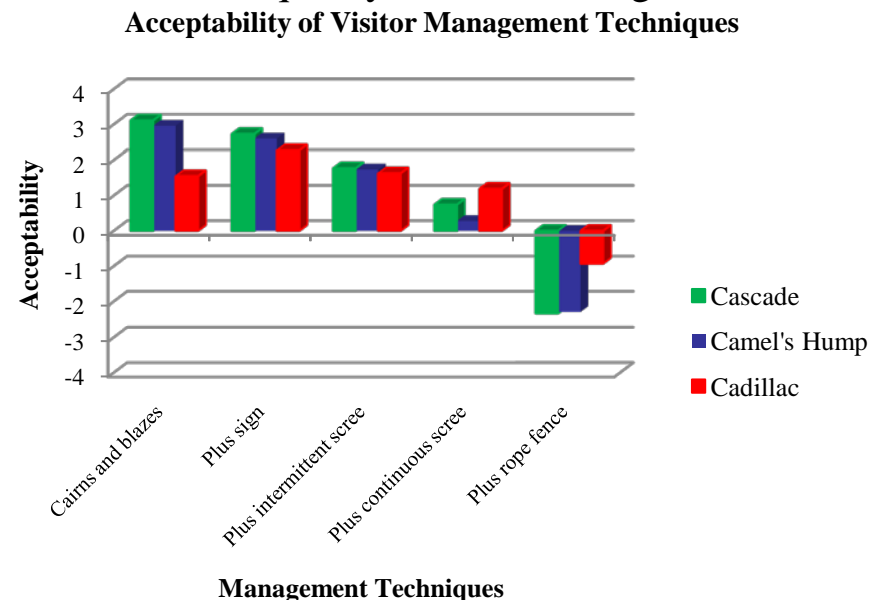
- Standards of quality: Trail impact
  - Discrepancy observed between the importance of trail impacts to visitors as suggested by the social norm curves and responses to open- and closed-ended questions in the survey that identified trail condition as an important factor in determining the quality of visitors' experiences
  - Appears as though visitors find a fairly high level of trail impact to be acceptable
  - Visitors' perceptions of impacts may be limited; however they may possess norms regarding the acceptability of conditions

- Standards of quality: Summit impact
  - Increasing levels of impact are increasingly unacceptable
  - Minimum amount of vegetation cover considered acceptable:
    - Cascade: 44%
    - Camel's Hump: 43%
    - Cadillac Mountain: 47%
  - What visitors typically saw:
    - Cascade: 62%
    - Camel's Hump: 72%
    - Cadillac Mountain: 67%

- Standards of quality: Trail management



- Standards of quality: Visitor management





# Results: Stated Choice Analysis

- Visitor preferences for indicators of quality:
  - There were differences in the importance placed on the six indicator variables
  - The number of people off-trail was the most important indicator of quality
  - Trail and visitor management practices were assigned less importance than resource or social conditions
- Visitor preferences for standards of quality:
  - Visitors were able to distinguish among the three standards of quality examined for each indicator variable
  - The majority of respondents preferred low levels of resource impact, few other visitors, and low intensity of management
  - These findings are consistent with those of previous studies (e.g., Bullock and Lawson, 2008; Cahill et al., 2008)
- Comparison among three study sites:
  - Half of the indicator variables differed
  - Respondents felt similarly about trail management practices
  - Preferences for conditions at Cascade and Camel's Hump were notably similar
- Visitors prefer to trade off higher levels of management to minimize the number of people who walk off-trail
- Findings suggest that mountain summits should be managed to provide a range of recreation opportunities

# Results: Land Cover Analysis

- Relative cover, as a percentage of the summit area:

- Vegetation:

- Cascade: 20.4%
- Camel's Hump: 44.25%
- Cadillac Mountain: 44.29%

- Lichens:

- Cascade: 3.14%
- Camel's Hump: 32.7%
- Cadillac Mountain: 36.25%

- Organic Soil:

- Cascade: 1.78%
- Camel's Hump: 0.52%
- Cadillac Mountain: 0.39%

- Mineral Soil:

- Cascade: 4.72%
- Camel's Hump: 0.59%
- Cadillac Mountain: 6.73%

- Bedrock:

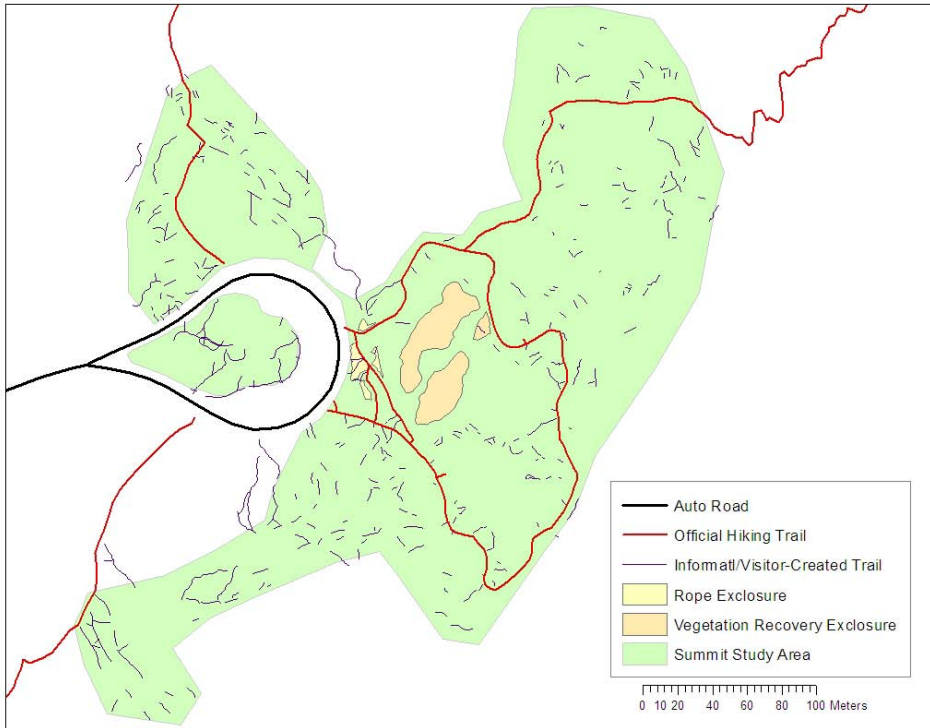
- Cascade: 68.45%
- Camel's Hump: 20.11%
- Cadillac Mountain: 11.27%

- Significant differences were found in the amount of vegetation cover, lichen cover, exposed soil, and bare rock



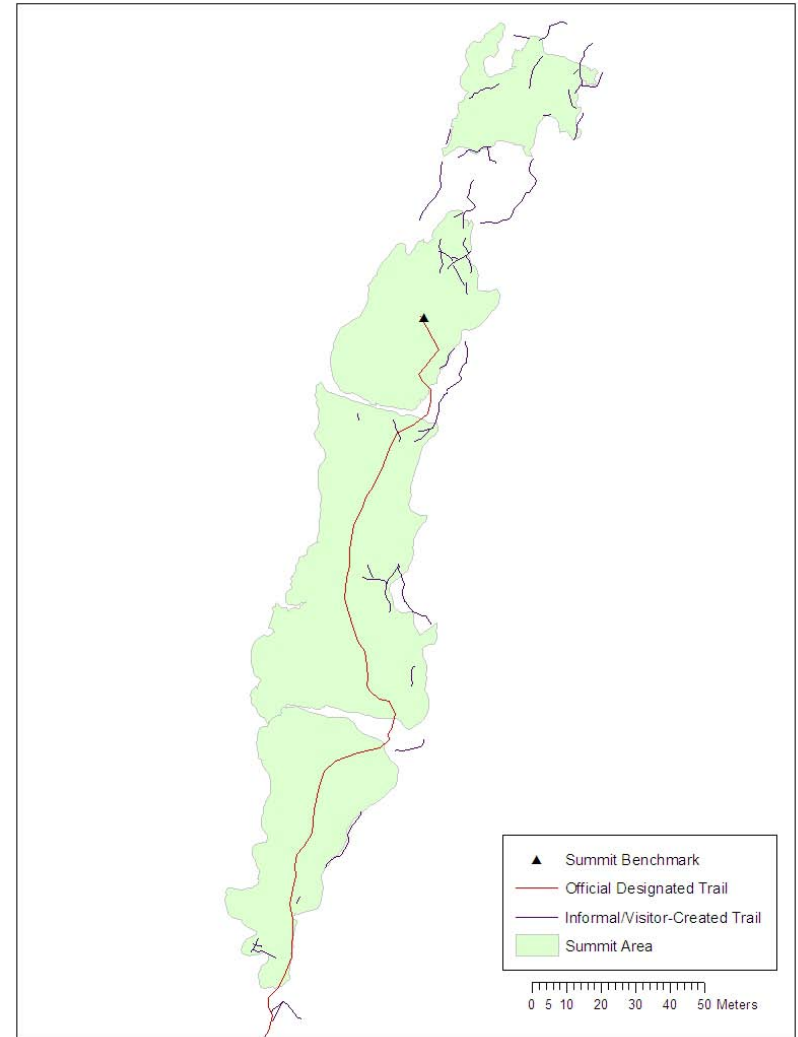
**Cadillac Mountain**, Acadia National Park, ME

# Results: Trail Assessment



## Cadillac Mountain:

- 335 visitor-created trail segments
- Linear extent = 1.6 miles (summit loop trail = 0.3 mi)
- Tend to be highly impacted (over half classified as Condition Class 4 or 5, with significant impacts to vegetation and soils)



## Cascade :

- 45 visitor-created trail segments
- Linear extent = 0.25 miles
- Tend to be highly impacted (about  $\frac{2}{3}$  classified as Condition Class 3 or higher)

# Project Outcomes and Outreach

- Presentations of results given at numerous professional meetings and conferences (see List of Products)
- Discussed project findings with Julia Goren, Program Coordinator for the Adirondack High Peaks Summit Stewardship Program
  - Cascade will become a new focus for stewardship and restoration efforts
  - Planned projects include closure of some visitor created trails, better trail definition, and installation of signs informing visitors of impacts
  - “Carry A Rock” program to begin summer of 2009
    - Hikers will carry rocks that will be used to stabilize soils, build cairns, and define trails



**Cascade, Adirondack State Park, NY**

# Implications and Applications in the Northern Forest Region

- Indicators and standards of quality can be developed and used to help define and manage high quality recreation opportunities on mountain summits
- Use levels, resource conditions, and management practices are good indicators of quality for managing mountain summits
- Managers may want to pay special attention to the indicators of quality identified by the survey results, as visitors considered these to be important in defining the quality of their experience
- Visitors prefer to trade off higher levels of management to minimize the number of people off-trail
- Visitors prefer low resource impacts, few other people, and low intensity management
- The condition of summit resources may be related to how the summits are managed
- Differences were observed among summits in regard to the acceptability of different conditions, the value placed on different indicators of quality, and the condition of summit resources
- Visitors overestimated the amount of vegetation cover present on summits, and underestimated the extent and severity of impacts
- Managers should not rely on visitors for objective information concerning the condition of summit resources
- Mountain summits should be managed to provide a range of recreation opportunities

# Implications and Applications in the Northern Forest Region

- Visitor norms and ecological assessments provide a scientific basis for formulating standards of quality
- Stated choice experiments provide an understanding of visitors' preferences and willingness to make tradeoffs
- The mountain summit ROS can be used to allocate, plan, and inventory recreational resources; estimate the consequences of management decisions on recreational opportunities; and match desired experiences with available opportunities within the Northern Forest



View of the Great Range from the summit of **Porter**, Adirondack State Park, NY





# Future Directions

- Future studies should consider including a broader sample of summit recreation opportunity settings (as defined by the mountain summit ROS)
- Stated choice should be further tested to determine its effectiveness as a measure of tradeoff behavior of survey respondents
- Computer-generated photographs should be used as a means to elicit preferences for alternative recreation opportunities
- The ROS should be employed to distinguish among recreation settings and compare visitor preferences for recreation conditions across a range of study sites
- Research should be conducted into the cause of the low lichen cover on the summit of Cascade
- Future research should explore the use of GPS tracking of visitors to determine the relationships between recreation use and resource condition
- Experimental studies could determine the effectiveness and acceptability of various management practices in limiting off-trail travel (e.g., Park et al., 2008)

# List of Products

- **Peer-reviewed publications**
  - Goonan, K., & Manning, R.. (in prep). Indicators and standards of quality for recreation on mountain summits in the Northern Forest. Target Journal: *Leisure Sciences*. Anticipated completion: 2010
  - Goonan, K., Monz, C., and Manning, R.. (in prep). Recreation on mountain summits in the Northern Forest: Resource conditions and visitor standards. Target Journal: *Mountain Research and Development*. Anticipated completion: 2010
  - van Riper, C.J., & Manning, R.E. (in prep). Tradeoffs among resource, social, and managerial conditions on mountain summits of the Northern Forest. Target Journal: *Leisure Sciences*. Anticipated completion: 2010
  - van Riper, C., Reigner, N., & Manning, R. (in prep). Experience use history and perceived impacts of visitors to Cascade Mountain, NY. Target Journal: *Adirondack Journal of Environmental Studies*. Anticipated completion: 2010
- **Master's Theses**
  - Goonan, K.A. (2009). Protecting natural resources and the visitor experience on mountain summits in the Northern Forest: A framework for management
  - van Riper, C.J. (2009). Tradeoffs among resource, social, and managerial conditions on mountain summits of the Northern Forest.
- **Conference Proceedings**
  - Goonan, K., Manning, R., van Riper, C., Monz, C. (in press). Managing recreation on mountain summits in the Northern Forest. *Proceedings of the 2009 Northeastern Recreation Research Symposium*.
- **Abstracts**
  - Goonan, K., van Riper, C., Manning, R., & Monz, C. (2007). Using science to manage Northern Forest tourism and recreation. *Adirondack Journal of Environmental Studies*, 14(2), 6.
- **Other publications**
  - van Riper, C.J. (in review) A sense of place in the Adirondacks. *Peeks Magazine*.

# List of Products

- **Professional presentations**

- Goonan, K., Monz, C., Manning, R., Marion, J., Wimpey, J., & van Riper, C. (2009). *Recreation-related ecological conditions of mountain summits in the Northern Forest: A framework for management*. Presented at the George Wright Society Biennial Conference, Portland, OR.
- Goonan, K., Manning, R., van Riper, C. & Monz, C. (2009). *Managing recreation on mountain summits in the Northern Forest: Part I*. Presented at the Northeastern Recreation Research Symposium, Lake George, NY.
- Goonan, K., Manning, R., van Riper, C. & Monz, C. (2009). *Managing recreation on mountain summits in the Northern Forest: Part I*. Presented at the Northeastern Alpine Stewardship Gathering, Lake Placid, NY.
- Goonan, K., Manning, R., Keeton, W., & Kolodinsky, J. (2008). *Recreation-related ecological conditions of mountain summits in the Northern Forest: A framework for management*. Presented at the University of Vermont Graduate Student Research Symposium, Burlington, VT
- van Riper, C. Manning, R., Goonan, K., & Monz, C. (2009). *Managing recreation on mountain summits in the Northern Forest*. Presented at the International Symposium on Society and Resource Management, Vienna, Austria.
- van Riper, C., Manning, R., Goonan, K., & Monz, C. (2009). *Managing recreation on mountain summits in the Northern Forest: Part II*. Presented at the Northeastern Alpine Stewardship Gathering, Lake Placid, NY.

# List of Products

- **Professional presentations (continued)**
  - van Riper, C., Manning, R., Goonan, K., & Monz, C. (2009). *Managing recreation on mountain summits in the Northern Forest: Part II*. Presented at the Northeastern Recreation Research Symposium, Lake George, NY.
  - van Riper, C., Manning, R., Goonan, K., & Monz, C. (2009). *Tradeoffs among resource, social, and managerial conditions on mountain summits of the Northern Forest*. Presented at the George Wright Society Biennial Conference, Portland, OR.
  - van Riper, C., Manning, R., Mickey, R., & Ventriss, C. (2008). *Tradeoffs among resource, social, and managerial conditions on mountain summits of the Northern Forest*. Presented at the University of Vermont Graduate Student Research Symposium, Burlington, VT.
  - van Riper, C., & Goonan, K. (2008). *Research to support sustainable management in the Northern Forest*. Presented at Acadia National Park, Bar Harbor, ME.