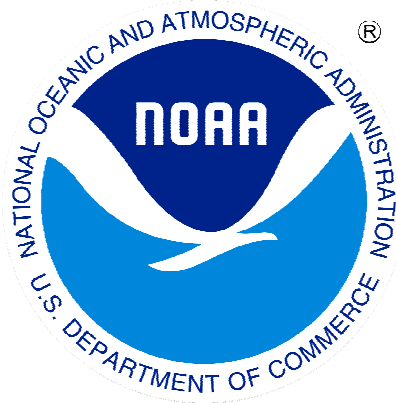




# Climate, Weather, and Tourism Workshop: Issues and Opportunities

November 14-15, 2008

## Summary Report



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This document was composed by Michelle Covi, Devon Eulie, and April Evans, doctoral students in the Coastal Resources Management Program along with Ryan Covington, geography student and graduate assistant, CST, and Professors Patrick Long, Director, CST and Scott Curtis, Atmospheric Scientist, Department of Geography.

# Contents

	<b>Page</b>
Executive Summary.....	4
Keynote Presenters.....	5
Introduction and Welcome.....	6
Importance and Potential of This Gathering .....	7
Trends in National and Regional Recreation and Tourism Behaviors.....	8
Introductory Comments—Climate Impacts on Tourism Businesses.....	8
Application of Climate Data to Tourism Business Decision-Making.....	9
Tourism Business Owners and Operators Reactor Panel.....	9
The "Footprint" of Tourism in the North Carolina Economy.....	11
Climate and Tourism—Impacts and Adaptations.....	11
Climate and Weather Trends Impacting North Carolina's Tourism-- Agency Responsibilities.....	12
Case Studies on Climate, Weather and Tourism.....	13
Climate and Tourism Index.....	14
Sector Perspectives on Climate, Weather and Tourism.....	14
The Future of the Travel Industry in a Climate Changing World.....	16
Wrap-up and Next Steps.....	16
Selected Resources.....	17
Climate, Weather and Tourism Workshop Schedule.....	18

## Executive Summary

*Drs. Scott Curtis and Patrick Long*

In November, 2008, approximately 100 scientists, academics, public policy officials, non-profit leaders, and business owners, met on the campus of East Carolina University (ECU) for a Climate, Weather and Tourism workshop. Sponsored by ECU's Center for Sustainable Tourism in partnership with the National Climatic Data Center, North Carolina Sea Grant, ECU's Institute for Coastal Science and Policy and a host of ECU colleges and departments, the purpose of the gathering was to address the short and long-term impacts of weather and climate fluctuations on the economic vitality of the tourism industry. The workshop explored the frameworks necessary to connect scientific information with short and long-term decision-making needs of tourism businesses. Workshop goals were to provide a forum to explore the interchange of scientific information with short-term decision-making needs of tourism businesses; identify the questions that need to be answered in order to make this interchange effective; and create an organizational structure that serves as the policy-making framework for the long-term management of a climate, weather and tourism initiative.

Tourism is a major economic driver of North Carolina accounting for \$17.1 billion in travel expenditures, \$4.2 billion in payroll, \$2.5 billion in tax receipts and employing 198,900 residents. The North American Industrial Classification System (NAICS) identifies a total of 6,300 businesses in the Arts, Entertainment, and Recreation Sector of tourism and 20,896 businesses in the Accommodation and Food Service Sector in North Carolina, most being small and mid-size in nature. In the 20 coastal counties, most vulnerable to rising sea levels and severe weather events, there are 1,027 businesses in the Arts, Entertainment, and Recreation Sector and 2,815 businesses in the Accommodation and Food Service Sector. Tourism is important as it stimulates economic development, creates new jobs, generates additional income, spawns new businesses, diversifies the local economy, adds new products, produces tax revenues, and improves the quality of life of local communities.

Climate and weather are important criteria for choosing a tourism destination and can determine the appeal of a location in absolute terms or relative to other destinations. The diversity of North Carolina's weather and climate stems from its varied terrain, juxtaposition with the Atlantic Ocean, and geographic location at the northern edge of the "subtropics". This diversity enables tourists to enjoy a wide range of activities. For instance, the Outer Banks of North Carolina are continuously battered by wind and swells that make it a prime spot for water sports. However, the benefits of the climate are mixed with drawbacks. Severe storms, along with icing, drought, and other hazards place North Carolina on a dubious list as having the most billion dollar weather disasters in the nation. Scientific advances have enhanced atmospheric observations, improved short term weather forecasts and seasonal climate predictions, and begun to say something about the chance of an extreme event occurring. What has been lacking is clear communication between the scientists and the tourists and tourism businesses.

Throughout the workshop common trends, challenges, and opportunities were identified. Possibly of greatest importance is the increased awareness and interest in climate, weather, and tourism by policy makers, business owners, and on the part of individual travelers. There are significant changing trends in values, cultures, environments and demographics surrounding this topic that have important economic and community quality of life implications.

This event was a significant starting point, a perfect storm if you will, on the journey to increase awareness of the impacts of weather and climate events on tourism businesses, on possible ways to best link scientific data with tourism business decision-making, to identify important research and management questions, and to establish working relationships among the many and varied stakeholders. We sincerely thank all those who contributed to a most stimulating, thoughtful and productive event.

## Keynote Presenters

### **H. Ken Cordell, PhD, Pioneering Scientist and Project Leader, USDA Forest Service.**

Dr. Cordell's work covers trends and futures of outdoor recreation, demographic and societal trends, natural amenity migration and amenity values, and public land use and values. He has produced five books; the latest entitled *The Multiple Values of Wilderness*. He is a lead scientist for the U.S. National Survey on Recreation and the Environment, a survey begun by the Outdoor Recreation Resources Review Commission in 1960. Dr Cordell has authored over 315 scientific and other technical papers dealing with Americans' relationship with their natural lands, for both national and international audiences. In 2006 he was appointed Pioneering Scientist, the most distinguished appointment a Forest Service scientist can receive, one of six in the history of the Forest Service.



### **J. Neal Lott, Chief, Data Access Branch, National Climatic Data Center, NOAA.**

Neal Lott graduated from North Carolina State University with a degree in Meteorology in 1982 and began his career that year with the US Air Force in Asheville, NC, as a civilian meteorologist. His main duties with USAF were in IT management and quality control of global climatic data. In late 1991, he moved to NOAA's National Climatic Data Center (NCDC) in Asheville as a Physical Scientist involved in software development for climatic applications. This evolved into management of various projects related to global data integration and data access. His current role is Chief of the Data Access Branch (DAB) of the Climate Services Division of NCDC. DAB employs 30 people focusing on access to various types of data (station-based, radar, satellite, model, etc), products and applications, and engagement of various industrial sectors.



### **Dr. Daniel Scott, Chair, WMO Expert Committee on Climate and Tourism and Canadian Research Chair in Global Change and Tourism, University of Waterloo, Canada.**

Dr. Scott has worked in climate change for 10 years and is the author of over 60 publications related to climate change impacts and adaptation in the tourism industry and in protected areas. Dr. Scott is also co-chair of the International Society of Biometeorology's Commission on Climate Tourism and Recreation. He is the lead author of the 2007 report 'Climate Change and Tourism: Responding to the Challenges' published by the World Tourism Organization. He has been a contributing author to the United Nations Inter-governmental Panel on Climate Change Third and Fourth Assessment Reports and recently testified to a US Senate Committee on the issue of climate change and outdoor recreation.



### **Ken Erickson, Senior Director of Development, Great Wolf Resorts, Inc.**

Ken Erickson supports Great Wolf Resorts with the expansion on new resort locations. As a committee chairman for Project Green Wolf, an eco-friendly initiative, Ken leads the brand's efforts in energy reduction and sustainable building practice. Mr. Erickson graduated from Southern Illinois University in 1988 with a Bachelors of Science degree in Geology. The majority of his study was in hydrogeology. He spent the first several years of his career in the Environmental Science field where he focused on providing ground-water remediation efforts for several large private and public institutions. His transition into real estate development began in 1996. For over 12 years Ken has managed the construction of dozens of retail and hospitality projects in 35 different states.



## Introduction and Welcome

*Dr. Patrick Long, Director, ECU Center for Sustainable Tourism*

Welcome, and thank you for being with us today. My name is Pat Long and I am the Director of the Center for Sustainable Tourism here at ECU. A few weekends ago I was headed north on Hwy 12 on the Outer Banks near Hatteras on my motorcycle riding in the wind and rain--soaking wet--when I came upon a stretch of road where the sky was filled with what seemed to be hundreds of kite boarders. Apparently, what to many would seem to be miserable weather was in fact, the “perfect storm”.



Weather fluctuation and tourism are main ingredients in our discussions over the next two days; throw in a bit of climate change and we have the necessary makings for an interesting batch of economic, environmental and community impacts, both positive and negative.

The Center for Sustainable Tourism, a relatively new entity here at ECU, is working to support research, academic activities and community programs in tourism which contribute to our state’s economy. Tourism that can contribute new revenues, jobs, and local and state taxes derived from tourists who support the services we all have come to expect. But, of equal importance to our mission is the continued health and vitality of the places and people who make up the destinations that attract our visitors. Tourism by its nature both contributes to, and is impacted by, the forces of Mother Nature; it is the responsibility of all of us to strive for a balance of economic viability with socio-cultural and environmental enhancement and equity.

We know that tourism is significant to our communities. Without tourism, many community amenities, including quality restaurants, convenience stores, retail shopping, cultural, educational and historic offerings, special events, and outdoor recreation opportunities, would substantially decline or disappear. We also know that climate and weather significantly impact tourism—in the type of offerings, the consistency of products and services and the length and quality of tourism seasons, the health of tourists, and the quality of tourism experiences.

We have some clear objectives for this gathering. First, we would like to develop a strategy for raising awareness of issues linking tourism, weather and climate. Second, we would like to develop a framework for collaborative research on climatic risks, opportunities, and information needs for reducing impacts on our state’s tourism industry. Third, we would like to identify sources of data and potential partnerships to investigate interactions of tourism, weather and climate in order to provide usable information for planning and management. The World Tourism Organization in recent meetings addressing climate and tourism, noted that climate is perhaps the most important influence on the choice of leisure travel destinations.

We do know that climate scenarios need to be more local specific and there is a need to increase understanding of the economic costs of creating favorable tourism conditions. We know there is a need for new management strategies that take into account a changing resource base and effects on vegetation, wildlife and recreational choices. We know there is competition to this region and opportunity costs to the tourists we desire. And, we need to anticipate resource conflicts due to competition for scarce water resources and determine the process for resolving such conflicts.

We have the “perfect storm” brewing in this room. We have scientists, academics, policy makers, business owners and operators and students at all levels interested in and committed to, a better understanding of climate, weather and tourism. We have with us experts whose knowledge and insight can add to our ability to respond to the research and management challenges facing the tourism industry and its many sectors. And, we have an institution poised to provide leadership to our Eastern region and across North Carolina, from Manteo to Murphy, on issues of great economic and community significance.

## Session Summaries

### Importance and Potential of This Gathering

*Dr. Deirdre Mageean, Vice Chancellor for Research and Graduate Studies*

“The most important fact about [the planet] is that an instruction book didn’t come with it.” Futurist inventor and ecologist Buckminster Fuller encapsulated the great challenge we face in the global community today, of balancing social development and preserving the planet’s natural resources.



The Center for Sustainable Tourism here at East Carolina University takes an integrated approach toward addressing the needs and issues facing our tourism industry. As entrepreneurs, scientists and educators, and culturalists, one tries to understand the interdependence of economic development and environmental sustainability. We are excited to have this strategic collaborative gathered here today forging the science linkages that will inform the changing needs of tourism.

On behalf of the Division of Research and Graduate Studies here at ECU, I welcome each of you to our campus and to this first Climate, Weather and Tourism event. ECU has for some time now been conducting research and offering educational programs about climate both on and off-campus. Two recent examples include the publication entitled *North Carolina’s Coasts in Crisis: A Vision for the Future* and an additional report entitled *Global Warming and Coastal North Carolina*, both authored by Professors Stan Riggs, Steve Culver and colleagues. The second of these reports was prepared in response to Senator Marc Basnight’s request to ECU research scientists for a background paper on the problems of global warming and proposed mitigation efforts.

The Center for Sustainable Tourism could not have organized this workshop today without sponsorship by the National Climatic Data Center, NC Sea Grant and ECU’s Institute for Coastal Science and Policy. We thank our sponsors not only for providing funding but also for being active participants in the program and for being friends of this institution. It is this type of collaboration and cooperation among academic institutions, government agencies and industry that is critical to addressing the important socio-economic questions inherent in our topic today.

The Center is an interdisciplinary unit of the Division of Research and Graduate Studies established to support responsible tourism development across North Carolina and beyond. It supports research, academic offerings, and community outreach and will soon offer the nation’s first Master of Science in Sustainable Tourism. It also offers *greening* action practices and support for businesses, governmental institutions and individual travelers. The Center is developing a number of initiatives, including a study of the impacts of second home development on tourism and community quality of life, and an initiative in conjunction with the National Renewable Energy Lab and the University of Colorado to assess best practices in energy use for key tourism sectors.

As a research institution, our focus centers on the important questions that must be addressed to solve societal problems. Tourism and its ancillary industries are inexorably linked to the viability of North Carolina’s economy, accounting for some \$17 billion in travel expenditures, more than \$4 billion in payroll, \$2.5 billion in tax receipts, and employing some 200,000 residents. It is imperative that our tourism industry has the advantage of every available tool that informs a greater understanding of the complex effects of weather fluctuations and climate variability. We are delighted that you have joined us today to participate in this discussion. In designing the program before you, we have sought to balance the varied knowledge and experiences of scientists, educators, policy makers, nonprofit groups and entrepreneurs. It is our hope at ECU that we move forward together to meet the challenges ahead.

## Session Summaries

### Trends in National and Regional Recreation and Tourism Behaviors

*Dr. Ken Cordell, Pioneering Scientist and Project Leader, USDA Forest Service Research and Development*



*Introduction by Dr. Rick Niswander, Dean, College of Business*

Research examining trends in outdoor recreational activities and use of public resources is necessary for future planning and park management. To this end, a national survey on outdoor recreation and the environment was conducted and then compared with historical changes in technology and recreational culture. Historically, the growth of the recreation industry is driven by the economy. Recently, advances in technology for automobiles and the internet have changed how people communicate and recreate. A shift in the preferred types of outdoor recreational activities has been noted and appeared within the survey results. Previous thought was that less outdoor recreation was taking place; however, survey results indicate this is not true, it is simply a shift in the type of recreation. The survey also noted a rapid increase in the number of women participating in outdoor recreational activities. Overall, participation in motorized vehicle recreation such as ATV use, wildlife photography, and highly physical sports (kayaking, snowboarding, and rock climbing) have increased. Participation in more traditional family activities such as picnicking, rafting, and visiting historical locations has decreased. There has also been a decrease in the visitation of public lands, including national forests. It is thought that an increase in travel costs, changes in the amount of leisure time, and shifts towards shorter recreational trips have impacted these trends in outdoor recreation and public land usage. For the future management of recreation and public lands we need to understand these trends in usage, the impacts of climate change on potential activities, and how future technologies will alter different types of activities.

### Introductory Comments—Climate Impacts on Tourism Businesses

*Dr. Steve Rebach, Associate Director, North Carolina Sea Grant Program*



Climate change has potentially long reaching affects on tourism. Tourist choices of locations and activities can be altered by these affects. Sea-level rise, changes in ocean chemistry, and changing patterns of coastal storms can degrade tourist destinations and activities. For example, shoreline erosion can lead to beach loss and a greater degree of storm impacts. Habitat degradation can lead to declining recreational fisheries and other related activities. These impacts can ultimately lead to lost revenue and a decline in the tourism industry in some areas and opportunities in other areas, such as here in North Carolina.

*Dr. John Rummel, Director, Institute for Coastal Science and Policy*



Coastal zones are dynamic systems impacted by hurricanes, sea-level change, erosion, and human activities. Not all of these impacts are necessarily detrimental, but we need to be aware of them, and to the degree we can, manage them responsibly. The ultimate goal is to ensure the health of these systems and preserve their attractiveness and value as a resource for everyone

## Session Summaries

### Application of Climate Data to Tourism Business Decision-Making

*J. Neal Lott, Chief, Data Access Branch, National Climatic Data Center, NOAA*

*Introduction by Dr. Lorry King, Director, Coastal Resources Management Program*

Neal Lott of NOAA's National Climatic Data Center (NCDC) demonstrated the usefulness of climatic data available at the NCDC website ([www.ncdc.noaa.gov](http://www.ncdc.noaa.gov)). There is a wide range of climate data available that can be used for tourism support. Generally, data from earth based instruments, such as weather stations, are used in commercial applications, while satellite data are used by the government. The NCDC website incorporates quick links to aid in navigation through the Geographic Information Systems (GIS) data, global hazards information, climate monitoring products and additional data sources. The most popular services include weather updates and weather forecasting data. These data are retrospective and available in spreadsheet compatible form, but can be used with other software. Regarding tourism, there is a database of climatologically "normals" and averages for over 7,000 US locations which may be of assistance to tourism managers in the decision-making process, for instance, determining when to expect to open for a seasonal operation.



### Tourism Business Owners and Operators Reactor Panel

*Moderator, Jason Oliver, College of Business*

The main questions that were asked of the panel were to explain how weather and climate impacts their business and what steps are taken to manage those impacts, as well as how they utilize existing weather and climate data.

*Jeff Greiner, Vice President of Marketing, Wildwater, LTD. Asheville, NC.*

As a tourism business with clear connections to weather, communication of weather conditions and the perception of those conditions strongly impact the whitewater rafting business. For example during the recent drought conditions, water on the rivers was very low and the number of users and types of activities became limited. Clear communication of those conditions as well as potential alternative activities proved to be extremely important for future business opportunities. The need to tailor communications based on the target audience is also important.



*Bob Farren, Director of Grounds and Golf Course Management, Pinehurst Resort & Country Club.*



Climate issues such as the recent drought can strongly impact the Golf industry. It also creates opportunities to set an example for the rest of the community. With the drought, the golf course implemented water conservation strategies. The industry is also heavily influenced by the media, a factor that also needs to be well managed to prevent losses in revenue. The industry primarily utilizes climatic data relating to plant growth for landscaping and short-term weather forecasts.

*Patricia McRitchie, Owner/Operator, McRitchie Winery and Cider Works*

As with many of the businesses represented in this panel, wineries are extremely weather dependent. Precipitation and temperature can make a huge difference in the yearly crop. The local weather conditions also play an important role in visitation to the winery's tasting rooms and grounds. Currently a study is underway to examine the habits of visitors in relation to the weather conditions. Work is also being done to integrate tourism with other local attractions to draw in visitors who are in route to other locations.



## Session Summaries

### Tourism Business Owners and Operators Reactor Panel (continued)

**Tim Lampkin, Director of Convention Sales and Group Services, Asheville Convention & Visitor Bureau**

The current focus in Asheville is to manage the location and foster relations between tourism and the community in an effort to create a sustainable industry. To that end funding is provided for local attractions and community resources such as gardens and athletic fields. Research is also being conducted to examine what the primary attractions are for tourists, both at the location and along the way, as well as, how the weather impacts those experiences. It was determined that providing a diverse range of activities improves sustainability and resilience of tourism at a location.



**Carolyn McCormick, Executive Director, Outer Banks Tourism Authority**

Success in tourism on the Outer Banks is measured by the ability to bring in visitors year around, not just during the more traditional tourist season. While climate plays a large role in this industry, the media coverage of weather is what really impacts the decision making process for visitors. Short-term forecasts can be especially damaging to tourism as they can often be wrong or misleading to visitors. Communication to potential visitors about other conditions besides weather, such as fishing conditions and leaf color is also key. The industry needs to be able to better communicate all the activity options visitors have as well as provide alternatives that are not weather dependent such as indoor activities.



**Donna Kain, Assistant Professor, Department of English (Technical and Professional Discourse) and Natural Hazards Research Center**

Communication is a central part of the discussion of climate change and tourism. Issues within lines of communication between researchers, businesses, and consumers needs to be addressed as a part of any climate change management strategy. Businesses need to receive good information on how climate change could affect their sector of tourism. Consumers need to be informed on how weather and climate could impact their desired activities, but in a straightforward and understandable manner that aids in making decisions and planning activities. An honest line of communication between the consumers and managers is essential.

#### Panel Conclusions:

- Media coverage of local conditions strongly impacts user perceptions of the destination and its activities. This leads to the need for open lines of communication between the users and business regarding conditions and available opportunities.
- Businesses need to better understand what drives the decision-making process of users and then to tailor communication based on their target audience(s).
- Businesses need to have access to both short and longer-term climate and weather data in a form that allows for ease of access and interpretation; additionally, they need to better understand the management and economic benefits of the use of such data.

## Session Summaries

### The "Footprint" of Tourism in the North Carolina Economy

*Dr. Tom Allen, Associate Director, RENCI Engagement Center, ECU*



*Introduction by Dr. Joe Fridgen, Recreation and Leisure Studies*

Tourism in North Carolina represents \$17 billion in domestic spending alone and employs almost 200,000 people. Examining such a large industry in relation to future climate change is a huge challenge. Current work has focused on examining factors such as trends in weather and outdoor, or weather and climate dependant activities. For example, the wine tourism industry has been increasing now drawing as many as 800,000 visitors to the state—it is heavily dependent on weather and climate. There has also been a rise in extreme weather sports such as kite surfing and whitewater rafting. Studies have examinee how transportation and access to locations affects these activities. Other research has examined factors such as resource competition, the environmental impact of tourist activities, and their susceptibility to environmental hazards. Competition exists for resources between different types of activities such as commercial vs. recreational fishing, agriculture vs. aquaculture, and many others. Conflict also exists between conservation of natural environments and their use for transportation and recreation. The environmental impact of these activities and their associated development on natural resources (i.e. pollution) needs to be further studied and accounted for in management plans. The vulnerability of recreational activities to hazards such as hurricanes and sea-level rise also needs to be better assessed. In conclusion, managers need to consider the following points and suggestions in relation to the tourism industry in North Carolina:

- Dependency of high amenity areas on transportation (uneven, needs more measurement)
- Consideration of weather and climate opportunities for tourism as well as the threats
- Measurement of tourism indicators of weather and climate (relationships and benchmarks)
- Adaptation of management approaches to handle emerging resource conflicts
- Building in resilience for potential catastrophes and long-term-threats



### Climate and Tourism—Impacts and Adaptations



*Dr. Daniel Scott, Chair, WMO Committee on Climate and Tourism, Canadian Research Chair in Global Change and Tourism, University of Waterloo, Canada*

*Introduction by Ryan Covington, Geography/Climate Graduate Student*

Recently there has been greater interest in the relationship between tourism and climate change. People are beginning to recognize that tourism is a climate sensitive sector similar to transportation. This has lead to more and better work understanding the many and varied sectors of this industry and how best to utilize new climate and weather information and technologies. Over the last few years the question has developed of; what impact climate change will have on tourism businesses? Several committees and conferences worked to address this question and have suggested several approaches for further study, including examining current links between how weather conditions and climate, and how the way that information is conveyed, impacts tourist's decision making process. The media plays a large role in how tourists receive their information and interpret it, subsequently impacting tourism related businesses. Misinformation or a lack of reliable, easily accessible information can hurt these businesses. On the other hand, timely and appropriate media coverage can increase exposure of those businesses to new markets. It was also suggested to create risk assessments, work on capacity building in different regions, and create tailored plans for adaption to climate change. We also need to examine the ability of the tourism sector to respond to weather and climate, specifically in response to extreme events such as hurricanes. The use of a systems approach to these questions and issues could ultimately expand the tourism industry and aid adaptation to changes in weather and climate.

## Session Summaries

### Climate and Weather Trends Impacting North Carolina's Tourism

#### ---Agency Responsibilities



*Moderator, Carolyn McCormick, Executive Director, Outer Banks Tourism Authority*

#### **Dr. Ryan Boyles – Director, State Climate Office of North Carolina**

The State Climate Office is a public service center that connects clients to university research and focuses on state needs, specifically community education and outreach. North Carolina has the most complex climate in the Eastern region, due to the highly variable conditions. This high variability leads to limited predictability. North Carolina's tourism economy is very sensitive to climate variations, thus a strong focus on high quality climatic data collection is needed. Additionally, there is a need for better monitoring strategies for environmental climate data, a need for better timeliness of data (real time data), and a need for a transition from historical climate data to current climate data. A primary concern for climate data is the translation of scientific data for use by the tourism industry. Large quantities of climate data exist, but the data are poorly understood. A strong effort must be implemented to educate K-12 students about climate concerns, to foster collaboration between scientists and professionals, and to continue climate research at the community and state levels.

#### **Dr. Peter Robinson – Director, Southeast Regional Climate Center**



The Southeast Regional Climate Center acts as an interchange between climate institutions, and a data resource for federal observations. There are six regional climate centers in the United States. Each regional center is responsible for the quality control of the data and providing weather probabilities. The Southeast Regional Climate Center is not responsible for forecasting, but focuses on climate monitoring and identifying impacts of climate change.

The center also takes part in data collection and historical analysis of climate data. Future needs identified by the Southeast Regional Climate Center include evaluating climate change and assessing climate trends. User needs identified by the Southeast Regional Climate Center include monitoring climate conditions, identifying local changes and variability, and assessing long-term changes.

#### **Dr. Jessica Whitehead – Regional Climate Specialist, South Carolina/North Carolina Sea Grant Extension Program**



The Sea Grant Climate Extension Program focuses on climate extension and acts as a bridge between the scientific community and stakeholders. The Extension Program does not work under the assumption that simply providing information is enough, but rather attempts to interpret the language gap between the scientists and the communities. The Extension Program focuses on risk assessment, climate mitigation, and user needs assessments. To date, the Extension Program has created a Frequently Asked Questions (FAQ) sheet and a Climate Extension Blog. Needs identified by the program include community and professional workshops, additional online resources, and suggestions from the scientific community and stakeholders.

#### **Dr. Stan Riggs – ECU Distinguished Professor, Department of Geology**



North Carolina has a unique coastal system which is every changing. The tourism industry, built on the state's natural resources, has replaced tobacco and textiles as a primary source of revenue. Thus, water quality, fisheries, and development have been beneficial to the tourism industry. Locals residing on the coast recognize the changing climate. Overall, the coast is changing with the old shoreline of North Carolina once being located at Interstate 95. The coastal system has been moving landward for 18,000 years. Sea-level is also rising at a gentle rate of 18 inches every 100 years. However, when sea-level rise is paired with storm activity, the process is no longer gentle. The pattern of storm activity is important to monitor, not simply the number of storms. To this end, shorelines are moving and barrier islands are narrowing. However, select state officials are recognizing climate change as an issue, but education and public will is needed to influence change.

## Session Summaries

### Case Studies on Climate, Weather and Tourism

*Introductions, Dr. Jamie Kruse, Director, Natural Hazards Research Center*

***Bald Head Island Conservancy , Dr. Suzanne Dorsey, Executive Director.***

Bald Head Island Conservancy is an independent, not for profit founded in 1983 with the mission of conservation of sea turtles, preservation of land, and education, with over 14, 000 people visiting annually. Bald Head Island is a ferry accessible island, south of Wilmington with 200 acres of old growth forest. The residents of Bald Head Island try to live sustainably and work with public- private partnerships to make effective decisions about the environment. The island is part of the critically important barrier islands on the North Carolina Coast. Island habitats, such as the dunes, salt marsh, and in particular, the maritime forest, are important for the sustainability of the island. Bald Head Island Conservancy works to protect the dunes and the flora and fauna along their 14 miles of beachfront. The majority of the visitors come for bird watching, sea turtle observation and nature study. The Bald Head Island community is committed to slow development with low environmental impacts. Barrier islands, such as Bald Head Island are susceptible to negative impacts of sea level rise due to climate change and have worked to preserve the large vegetated dune system, which provides protection from storms, such as hurricanes. Solutions to the challenges faced by climate change are education, including partnering with educational institutions around the state, grass roots leadership to take positions on climate and conservation issues, and networks to share resources and successes.



***Grandfather Mountain, Luke Appling, Green Manager***

Grandfather Mountain is recognized by the United Nations as an international biosphere reserve, the only privately owned reserve included in this designation. Grandfather Mountain is an ecological island with unique biodiversity, due to elevation changes within a short distance. The resort was opened as a park in the 1950's for tourists by Hugh Morton. The majority of tourists visit the park to walk on the swinging bridge and for the mountain views; however, the area offers numerous amenities, including natural animal habitats and 13 miles of hiking trails. Climate change may exacerbate the unpredictable weather in this area. Air quality is extremely important to the enjoyment of the mountain and air pollution can obscure the views. In response to these environmental problems, Grandfather Mountain has several initiatives in sustainability including land conservation, waste reduction, energy conservation and education. The Nature Conservancy has conservation easements on much of the land which is managed, but not developed. Grandfather Mountain is slated for state park designation in order for the land under conservation easements to continue conservation beyond the current generation. Grandfather Mountain aims to improve its energy efficiency; to this end, an energy audit was conducted and sustainable practices such as replacing incandescent lighting with more energy efficient lighting and natural lighting,, installing high efficiency boilers as well as destratification fans to circulate heat, were implemented. The company purchase electricity from NC Green Power and is currently investigating the potential to produce renewable power on site through solar or wind generators. One example is the Green Fudge shop, which is a south facing building and takes advantage of the natural light, compact fluorescent lighting, solar radiant heat, bamboo flooring, and rain collection, and will be completely off-grid in a year. The park has implemented park-wide waste reduction programs including recycling and composting. Climate impacts anticipated by Grandfather Mountain include the loss of honey bees, increase in invasive species and changes in the forest ecology. Since air pollution can be clearly demonstrated in the mountains due to the reduction of distant views, Grandfather Mountain's education program teaches visitors about being environmentally responsible. Luke Appling, stated "Right now, from the mountain, we can see the Charlotte skyline about 20 times a year. We want to see it more – why not?"



## Session Summaries

### Climate and Tourism Index

*Drs. Scott Curtis and Jennifer Arrigo; Graduate Student Ryan Covington*



These researchers noted a need for useful and accessible climate data recently completing a pilot study to test a weather and climate index. Since North Carolina has a varied climate and landscape, there are different uses for climate data based on different locations. The Outer banks region of North Carolina was chosen as the study site because climate is one of the attracting characteristics for outer banks tourism. The study investigated the differences between perceptions of weather/climate pre-trip with whether the tourist's expectations were met. The researchers chose the APT Index to aid in determining these differences. The APT Index stands for aesthetic, physical, and thermal comfort. The researchers were specifically interested in perception of climate/weather versus behavior and the pilot study focused on four factors: temperature, cloud cover, humidity, and wind. Findings concluded that tourists preferred less cloud cover for sunbathing as well as less windy conditions. Also, tourists did not seem to consider humidity or temperature to be main factors in their decision-making process. Future implications identified through the pilot study included determining new ways to market tourism based on climate, identifying differences in the climate and weather perceptions of local beach-goers and tourists, conducting more research to determine if tourists' perceptions of climate and weather are consistent, and gathering more information about the role of weather in the decision-making process of a tourist.

### Sector Perspectives on Climate, Weather and Tourism

*Moderator, Dr. David Edgell, Hospitality Management Faculty and Scholar in Residence, CST*

*Dr. James Kleckley—Business and the Economy*



The Bureau of Business Research focuses on identifying differences in economic structure and growth within the state and between regions. Employment rates and business indicators are not uniform across the state. For example, Dare County is a tourist economy, as demonstrated in rentals, leasing, and food service. The workforce in Dare County is different than the workforce in the state as a whole. While North Carolina is losing manufacturing jobs, there is growth in other areas, such as health care and food service. The majority of the employment growth in the state has been concentrated in Charlotte and the research triangle area. The Bureau of Business Research looks at why different areas experience growth differently and how growth changes locally. The outlook for tourism is dependent on national trends and decisions but most importantly on local leadership and decisions. The national economic outlook for tourism is not good, but North Carolina will not be as severely impacted. Dare County may experience more impact, mostly in the construction industry, due to a decreased need to build more homes for tourists. Local leaders need to understand the local issues driving business growth and learn to balance economic growth with planned development, taking into account hazards, such as weather and climate change.

*Dr. Ron Mitchelson—Transportation*



Energy and transportation are key elements of tourism and major contributors to climate change. Surprisingly, we are less energy efficient in the area of transportation than we were in the 1970s. This lack of energy efficiency is due to an increase in miles traveled, with over 80% of drivers driving alone. Most of the energy associated with transportation is wasted with only 2% of a gallon of gas used to move the occupant of a vehicle. Aviation has a disproportional impact on emission of greenhouse gases. For instance, the absence of planes after the September 11, 2001 terrorist attacks led to a change in air temperature over those days.

## Session Summaries

### Sector Perspectives on Climate, Weather and Tourism (continued)

The system for assessing Aviation's Global Emissions (SAGE) has been developed to track the impact of aviation on temperature changes. In tourism, getting visitors to destinations is the critical energy issue with 84% of emissions in tourism used to get to the destination. Most travel in cars, but visitors traveling by air are making the biggest impact. When assessing the ecological footprint of a vacation, transportation is the largest component of most trips, which implies that the tourism industry is oil dependent. For the North Carolina tourism industry, which has a large eastern US cities tourist market, increased fuel prices may be a benefit. Canada is well positioned to increase tourism due to global warming, because it is expected to have a longer tourist season. Climate has an impact on transportation operations, such as weather effects on the landing of planes, and also on infrastructure, such as the building of roads. As climate change occurs there may be less hub structures utilized in air transportation. Roads in eastern North Carolina will also be vulnerable to sea level rise. Additionally, transportation is important in natural disasters since it takes 17-32 hours to clear the coast during an evacuation. Keeping transportation routes open is critical to tourism.

#### ***Dr. Nancy White—Stormwater Impacts on Recreational Water Use***

Stormwater is the number one source of pollution on the coast. With a projected 20% increase of population these problems are expected to cascade. Impacts from stormwater include the closure of more than 90% of shellfish beds due to sanitation issues, beach closings, and habitat disturbance which can impact fishing. Studies that compared differential land use, such as residential, national forest, and a well-managed farm, demonstrated that urban development supplied the majority of pollution from stormwater. In an ocean outfall study on the Outer Banks, in which outfalls were added to drain the highway and were attached to residential developments, flow reached 2.8 million gallons in one pipe for one storm, with significant pollution as measured by fecal bacteria contamination. This study used microbial source tracking to determine the sources of pollutants since the hydrology was very complicated. However, it was impossible to locate bacteria source through source tracking. The entire water budget needed to be managed in order to improve water quality. Education of the community is important thus the Coastal Studies Institute works with secondary schools to educate children and the public. There is also a need for green building techniques to reduce run-off and prevent water pollution.



#### ***Dr. Marian Swinker—Climate Change and the Range of Diseases and Invasive Species***

Climate change is becoming increasingly interesting to health professionals. Global warming will lead to an increased number of smoggy days, increased instances of disease, extended allergy season, and an increased poison ivy population due to a longer summer season. Lyme disease is expected to move into Canada as a result of warmer temperatures. Increases in extreme weather may result in flooding and saltwater intrusion on the coast. As a result, there will be more mosquitoes, which are vectors for diseases, such as malaria and yellow fever. Chaga's disease, mostly observed in South America is moving north, and currently has been found in some dogs in Texas. Harmful algal blooms, such as red tides, may become more common with a warmer climate and may impact the tourism industry by causing visitors to be unable to swim in the ocean. Toxins, such as paralytic shellfish poisoning (PSP), which accumulate in shellfish and can affect marine mammals, are increasing in range as global temperatures increase. Another coastal organism expected to increase in population is *Karenia Brevis*, which can become a respiratory irritant and cause beach asthma attacks. Health professionals are tracking these diseases which may impact tourism as climate changes occur.



## Session Summaries

### The Future of the Travel Industry in a Climate Changing World

*Ken Erickson, Senior Director of Development, Great Wolf Resorts, Inc*

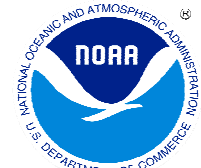
*Introduction by Dr. Glen Gilbert, Dean, College of Human Performance*



Great Wolf Resorts properties are indoor built water parks. By creating indoor water parks, Great Wolf Resorts has removed climate from the tourism equation. Until 1995, the Dells in Wisconsin relied mainly on seasonal outdoor recreation activities for tourism. In 1997, Great Wolf Resort created a guaranteed vacation in Wisconsin by moving the activities indoors. This step immediately increased Great Wolf's tourism base by incorporating family-based tourism into their market. Now, Great Wolf Resorts properties work without climate restrictions and can market such in their numerous resorts throughout the United States. Great Wolf Resort also established Project Greenwolf, which focuses on educating children about the environment and sustainability. For Project Greenwolf, Great Wolf Resorts partnered with National Geographic to provide environmental education to children who are their guests. Project Greenwolf also aims to create green traditions for guests and "pack" members (employees). Great Wolf Resorts identified five steps to becoming a sustainable tourism industry. First, find a green leader. Second, set base line criteria for measurement. Third, start easy (e.g. change light bulbs and shower heads). Fourth, conduct monitoring and analysis of the changes implemented. And fifth, continued sustainability.

### Wrap-up and next steps

*Dr. Eileen Shea, Chief, Climate Services Division, NOAA's National Climatic Data Center*



Dr. Shea identified common trends, challenges, and opportunities throughout the Climate, Weather, and Tourism Workshop. Overall, there are changing trends in climate and tourism that have significant economic implications as well as changes in values, cultures, societies, environments and demographics dealing with tourism. Additional trends included:

- Climate is variable, but biological and physical patterns can be investigated;
- There is a need for regional and local information;
- There is a need for more data, research, assessment and education;
- There is a need for place-based approaches to climate change and investigation of climate in a multi-stress context; and
- There are emerging roles for governments, universities, communities and the public sector to collaborate on climate concerns.

Dr. Shea also identified challenges in climate, weather and tourism. The main challenge is incorporating a systems approach to climate study and in addressing climate policy issues. Additional challenges include:

- Stimulating and informing action;
- Engagement the media in climate issues;
- Increasing the engagement of public officials;
- The need to address the vulnerability of our natural resources and infrastructure; and
- The need for new institutions to support change.

## Session Summaries

### Wrap-up and next steps (continued)

Lastly, Dr. Shea identified opportunities presented during the Climate, Weather, and Tourism Workshop. Most notable is the increased interest in climate, tourism, and resource conservation. Additional opportunities included:

- Linking climate adaptation with risk hazard reduction;
- Incorporating risk management and adaptive management practices to “waterproof” the tourism industry;
- Enhancing awareness and improving communication both in the scientific community as well as with the public; and
- The need for improved forecasting, compilation of emerging data, and regional vulnerability assessments.

Specifically, there are opportunities for NOAA and ECU. NOAA has the opportunity to convey climate information in useful ways and to create new tourism products. ECU has the capacity through the Center for Sustainable Tourism and its many other university resources to further interdisciplinary research in climate, weather and tourism. Additionally, through partnerships and collaboration with the many businesses, agencies, universities and organizations represented at this workshop, ECU can contribute substantially to the continued economic vitality of the state and region’s tourism industry in this important arena of climate, weather and tourism.

## Selected Resources

Alvord, C., Long, P., Pulwarty, R. and Udall, B. (2008). Climate and Tourism on the Colorado Plateau. *Bulletin of the American Meteorological Society*, pp. 673-675.

Climate Change and Tourism – Responding to Global Challenges. (2007). Published by the World Tourism Organization and the United Nations Environment Programme, Madrid, Spain.

de Freitas, C., Scott D. and McBoyle, G. (2008). A second generation climate index for tourism (CIT): specification and verification. *Int J Biometeorol* 52:399–407.

Scott, D., McBoyle, G. and Schwartzentruber, M. (2004). Climate change and the distribution of climatic resources for tourism in North America. *Clim Res* 27: 105–117.

Riggs, S., Culver J., Ames, D., Malison, D., Corbett, D. and Walsh, P. (2008). North Carolina’s Coasts in Crisis: A Vision for the Future. A White Paper. Department of Geological Sciences, Thomas Harriot College of Arts and Sciences and Institute for Coastal Science and Policy, East Carolina University.

Bin, O., Dumas, C., Poulter, B., and Whitehead, J. 2007. Measuring the impacts of climate change on North Carolina coastal resources. Final Report to National Commission on Energy Policy.

**Climate, Weather and Tourism Workshop**  
**Willis Building Conference Room**  
**300 East First Street**  
**Greenville, NC 27858**

*We are committed to making this gathering as environmentally friendly as possible*

**Friday, November 14, 2008**

- 1:00 p.m. Welcome by Dr. Patrick Long, Director, Center for Sustainable Tourism
- 1:10 p.m. Importance and Potential of this Gathering  
Congressman Walter B. Jones, United States House of Representatives  
Dr. Deirdre Mageean, Vice Chancellor for Research and Graduate Studies
- 1:30 p.m. Trends in National and Regional Recreation and Tourism Behaviors.  
Dr. Ken Cordell, Pioneering Scientist and Project Leader, USDA Forest Service Research and Development.  
Introduction by Dr. Rick Niswander, Dean, College of Business
- 2:30 p.m. Comments by Professor Scott Curtis, Atmospheric Scientist and Workshop Co-Planner
- 2:45 p.m. Comments by Dr. Steve Rebach, Associate Director, North Carolina Sea Grant Program and Dr. John Rummel, Director, Institute for Coastal Science and Policy, ECU
- Application of Climate Data to Tourism Business Decision-Making—An Interactive Session with Tourism Business Owners and Operators.  
J. Neal Lott, Chief, Data Access Branch, National Climatic Data Center, NOAA  
Introduction by Dr. Lorry King, Director, Coastal Resources Management Program
- Tourism Business Owners and Operators Reactor Panel  
Moderator, Jason Oliver, College of Business  
Jeff Greiner, Vice President of Marketing, Wildwater, LTD. Asheville, NC.  
Bob Farren, Director of Grounds and Golf Course Management, Pinehurst Resort & County Club.  
Patricia McRitchie, Owner/Operator, McRitchie Winery and Cider Works  
Tim Lampkin, Director of Convention Sales and Group Services, Asheville Convention & Visitor Bureau  
Carolyn McCormick, Executive Director, Outer Banks Tourism Authority  
Donna Kain, Assistant Professor, Department of English (Technical and Professional Discourse) and Natural Hazards Research Center
- 4:45 p.m. Summary of the Afternoon and Preview of Tomorrow's Program  
Dr. Patrick Long, Director, Center for Sustainable Tourism
- 5:00 p.m. Social—Emerge Gallery in Uptown Greenville  
Hosted by Mayor Pat Dunn and City Manager Wayne Bowers
- 6:30 p.m. Dine with the Presenters.

## Saturday, November 15, 2008

- 8:30 a.m. The “Footprint” of Tourism in the North Carolina Economy  
Dr. Tom Allen, Associate Director, RENCI Engagement Center, East Carolina University Introduction by Dr. Joe Fridgen, Recreation and Leisure Studies
- 8:45 a.m. Climate and Tourism—Impacts and Adaptations  
Dr. Daniel Scott, Chair, WMO Committee on Climate and Tourism, Canadian Research Chair in Global Change and Tourism, University of Waterloo, Canada.  
Introduction by Ryan Covington, Geography/Climate Graduate Student and Graduate Assistant, Center for Sustainable Tourism
- 9:45 a.m. Climate and Weather Trends Impacting North Carolina’s Tourism—Agency Responsibilities  
Moderator, Carolyn McCormick, Executive Director, Outer Banks Tourism Authority  
Dr. Ryan Boyles, Director, State Climate Office of North Carolina  
Dr. Peter J. Robinson, Director, NOAA Southeast Regional Climate Center  
Ms. Jessica Whitehead, Regional Climate Specialist, South Carolina/North Carolina Sea Grant Extension Program  
Dr. Stan Riggs, ECU Distinguished Research Professor, Department of Geology
- 10:45 a.m. Break
- 11:00 a.m. Case Studies on Climate, Weather and Tourism  
Bald Head Island, Dr. Suzanne Dorsey, Executive Director, Bald Head Island Conservancy  
Grandfather Mountain, Luke Appling, Green Manager  
Introductions, Dr. Jamie Kruse, Director, Natural Hazards Research Center
- 11:40 a.m. Climate and Tourism Index  
Drs. Scott Curtis and Jennifer Arrigo; Graduate Student Ryan Covington.
- 12:10 p.m. Lunch on site
- 1:00 p.m. Sector Perspectives on Climate, Weather and Tourism  
Moderator, Dr. David Edgell, Hospitality Management Faculty and Scholar in Residence, CST  
Dr. James Kleckley--Business and the Economy  
Dr. Ron Mitchelson--Transportation  
Dr. Nancy White--Stormwater Impacts on Recreational Water Use  
Dr. Marian Swinker--Climate Change and the Range of Diseases and Invasive Species
- 2:00 p.m. The Future of the Travel Industry in a Climate Changing World  
Ken Erickson, Senior Director of Development, Great Wolf Resorts, Inc.  
Introduction by Dr. Glen Gilbert, Dean, College of Human Performance
- 2:45 p.m. Wrap-up and next steps  
Dr. Eileen Shea, Chief, Climate Services Division, NOAA’s National Climatic Data Center
- 3:00 p.m. Closing comments. Dr. Patrick Long, Director, Center for Sustainable Tourism



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November 14-15, 2008**