

# Stakeholder Engagement Report: Natural Resources

## Climate Change Preparedness in New Jersey

November 2013

*Prepared for the New Jersey Climate Adaptation Alliance by  
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This report was prepared for the New Jersey Climate Adaptation Alliance which is facilitated by Rutgers University. The views and insights in this report do not reflect the position of Rutgers University nor the members of the Alliance Advisory Committee.

## Introduction

With support from the Kresge Foundation, the New Jersey Climate Adaptation Alliance is currently involved in development of a set of state and local public policy recommendations to enhance climate change preparedness and capacity in New Jersey. The final outcome is expected to be a compendium of recommendations for state and local public policies that advance and support climate change preparedness, including recommendations related to financing and infrastructure investment, regulatory standards, planning and goal setting, outreach and education, community engagement, local zoning and codes, etc. The recommendations will reflect the consensus recommendations of the Alliance as represented by the members of the Alliance Advisory Committee.

As part of the *stakeholder outreach* stage of this project, the Alliance worked through a set of partners to reach out to key stakeholder groups within each of the targeted sectors. The purpose of this stakeholder engagement effort was to better understand the perceptions of climate change-related risk on the part of stakeholders, the nature of preparedness within the sector and additional needs to support enhanced adaptation and preparedness. In short, the stakeholder engagement effort is intended to identify areas where state and local policy can support greater climate change adaptation and preparedness within the targeted sector.

## Background on the Natural Resources Sector in New Jersey

The natural resources sector in New Jersey is a community of government agencies, quasi-government organizations, non-governmental organizations and resource users invested in the state's natural resources, defined here as ecosystems, flora and fauna. A large variety of habitats and species are found throughout New Jersey, including oak/hickory dominated forests in the north, loblolly/shortleaf pine forests in the south, a vast coastal plain province and 127 miles of Atlantic coastline.

Natural resources in New Jersey are protected and managed by a variety of state and federal agencies, quasi-government commissions and private non-governmental organizations. The New Jersey Department of Environmental Protection (NJDEP), mostly through its Land & Open Space, Parks & Forests, and Fish & Wildlife Divisions, owns and manages approximately 700,000 acres<sup>1</sup>. In addition, the U.S. Fish and Wildlife Service (USFWS) and National Park Service (NPS) own and manage about 105,000 acres of land and their associated species<sup>2</sup>. Endangered and threatened flora and fauna species are managed by NJDEP, USFWS and NPS. Game and non-game species and freshwater and marine fisheries are managed by NJDEP's Division of Fish and Wildlife. Finally, there are also

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<sup>1</sup> New Jersey Department of Environmental Protection.

<sup>2</sup> U.S. Department of Defense owns an additional 71,000 acres. Congressional Research Service, *Federal Land Ownership: Overview and Data*. February 8, 2012.

three quasi-governmental organizations – the Pinelands Commission, Highlands Council and Meadowlands Commission – that manage resources and development at a regional scale in New Jersey.

Private non-governmental organizations also work to conserve a variety of ecosystems and threatened and endangered species in the state. Several land trusts are owners of open space to protect key habitats from development and in some cases protect threatened and endangered species. In addition, the land trusts and other conservation organizations work to restore key coastal and upland habitats, improve forest and watershed health, and protect and restore threatened and endangered species.

Those who harvest or view fish and wildlife are also key stakeholders in the natural resources sector. There are approximately 95,000 hunters and 1 million anglers in the state<sup>3</sup>. In addition, in 2011, commercial fishermen landed approximately 162 million pounds of fish<sup>4</sup>. NJ DEP manages those species found mostly in state waters, including shellfish harvest, while the National Marine Fisheries Services manages marine fisheries found in federal waters (outside of three miles). Finally, there are approximately 1.6 million wildlife viewers in New Jersey<sup>5</sup>.

## Approach

Stakeholder outreach for the natural resources sector included a combination of online surveys, one-on-one conversations and listening sessions. The foundation of the outreach was an online survey conducted by Rutgers University in August 2013 to ascertain how stakeholders perceive climate-related risks and preparedness in New Jersey (Attachment A). The survey was sent to approximately seventy stakeholders in the natural resources sector who represent key divisions within NJ DEP, regional commissions/councils, federal partners, land trusts, watershed associations, a variety of conservation non-governmental organizations, hunters and anglers and commercial fishermen. Twenty-eight stakeholders responded. The online survey was supplemented with interviews with key stakeholders who represent a representative portion of a particular sub-sector, e.g., a state division, statewide conservation group or fishing association. In addition, due to the cross-over with the coastal communities and water resources sectors, feedback was also received at listening sessions set up by those respective sector leads.

The New Jersey Climate Adaptation Alliance also distributed an online survey to the participants of the New Jersey Land Conservation Rally, which was held in Newark, NJ on March 9, 2013. After the event, the survey link was e-mailed to approximately 300 registrants. Thirty-five respondents, a mix of government and non-profit land managers and

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<sup>3</sup> Southwick Associates. New Jersey – Hunting Fishing Economics of New Jersey 2011.

<sup>4</sup> National Marine Fisheries Service. Fisheries of the United States – 2011.

<sup>5</sup> Southwick Associates. New Jersey – Hunting Fishing Economics of New Jersey 2011.

the general public, completed the survey, which relates more specifically to land protection and management. The results of the two online surveys were very similar in terms of perceptions of risk and needed actions. A copy of the land conservation survey and its report is included in Attachment B

Finally, in December 2011, the Jacques Cousteau National Estuarine Research Reserve, New Jersey Conservation Foundation and The Nature Conservancy sponsored a workshop on land acquisition, conservation and stewardship in the face of climate change. During breakout sessions, attendees discussed current climate-related actions and identified additional research/information needs for adapting to climate change. Highlights from the workshop are included in this report, and the workshop minutes are included in Attachment C.

### **Stakeholder Perceptions of Climate Change Impacts**

There is strong agreement within the natural resources sector that climate change is occurring and is a risk to New Jersey. According to the natural resources sector survey, twenty-six (96%) of the respondents believe climate change is occurring, with slightly less agreement as to whether or not it is mostly caused by human activity. In addition, the majority of survey respondents (86%) do not believe that our state and local officials understand the implications of climate change for our region. See Attachment A for more information on survey results. With regards to the survey conducted at the Land Conservation Rally, 85% of respondents believe climate change is occurring. Nearly all respondents (94%) feel climate change is a risk to New Jersey and most respondents expressed little faith in state and local officials' comprehension of climate issues, with 80% disagreeing or strongly disagreeing with the statement "our state and local officials understand the implications of global climate change for my region." See Attachment B for more information on survey results.

In general, climate change and climate-related impacts are a major concern throughout the sector. However, this concern does not necessarily translate to resource managers prioritizing climate impacts. Working on the presumption that a healthier ecosystem will be more resilient to climate change, many stakeholders have chosen to focus on overall ecosystem health as opposed to one specific climate-related impact. Nevertheless, those who manage and conserve coastal habitats view sea level rise, which is much more tangible at this point in time, as an immediate threat that must be addressed.

Managers are very concerned about the climate-related impacts on ecosystem health, where even the smallest change in water temperature or quantity or rise in sea level can have dramatic impacts on an ecosystem, especially on sensitive species. However, while the impacts of climate change can have a very serious impact on ecosystems, flora and fauna, it is sometimes difficult to tease out the impacts of climate change as they can be inherently intermingled with overall ecosystem health. Most importantly, there is general agreement

among the natural resources sector that we do not yet have the requisite baseline information on the state of natural resources in the state and by extension do not fully understand how climate change will actually impact ecosystems, flora and fauna.

There are a variety of climate-related impacts that are of great concern to stakeholders within the natural resources sector. According to the August survey, *regarding impacts related to water*, stakeholders are most concerned about an increased occurrence and severity of flooding, higher water temperatures and more frequent and longer droughts. *Regarding impacts related to land*, stakeholders are most concerned about tidal wetland erosion/loss, beach/dune loss, soil erosion/loss and reduced water filtration. *Regarding impacts related to flora, fauna and people*, stakeholders are most concerned about critical species habitat loss, increased spread of invasive species and increased occurrence/spread of pathogens, pests and vector-borne diseases. This concern was reflected in the Land Conservation rally survey, where a majority respondents expressed “great” or “some” concern for nearly all of the water-related impacts, tidal wetland erosion and loss and critical species habitat loss, among other impacts. See attached survey reports for more detailed analysis.

#### *Land and Species Management*

Those stakeholders who manage flora and fauna species are particularly concerned about climate change. This is especially true for threatened or endangered species that are specialists; given that they prefer very specific habitat types, they are at particular risk to ecosystem changes. For example, tiger salamanders that inhabit vernal pools in Cape May County will be impacted by the slightest amount of sea level rise and associated increase in salinity, and the reproductive capabilities of bog turtles will be affected by the impact of precipitation changes on ephemeral wetlands. There is also concern about how minor temperature changes in cold water trout streams may impact fish populations. Many stakeholders are waiting on the outcome of NJ DEP’s habitat vulnerability assessment, habitat connectivity initiative and update of the state wildlife action plan to inform future conservation decisions.

The potential impacts of climate change are also changing the way in which some organizations manage their resources. Most commonly, stakeholders are reconsidering how they have prioritized species and conservation decisions. For example, a few stakeholders who manage both saltmarsh and upland areas are now focusing more on the management of salt marshes in order to keep pace with sea level rise. Some are struggling with how to manage invasive species; managers especially would like to better understand whether a new species that is shifting north is truly an invasive species or if it is a new natural state, and thus does not require as much management. Finally, with a shift in timing for migratory birds, managers want to better understand the impacts of these shifts on the ecosystem and any necessary shifts in management actions.

### *Land Protection*

Among those who work to protect open space in New Jersey, some stakeholders are adjusting land protection decisions based on climate models. For example, some organizations are no longer purchasing salt marsh, instead focusing on the protection of upland habitat to allow for the marsh to move inland as sea level rises. Some organizations are protecting open space with the goal of improving habitat connectivity in order to facilitate potential species migration to adjust to climate change. Again, many organizations are waiting on the results of a habitat connectivity assessment being developed by NJ DEP.

### *Forest Health and Watershed Management*

Given that healthy forests tend to contribute to healthy watersheds, organizations that focus on forest health and water resources have very similar concerns with about climate-related impacts. They are mostly focused on the overall health of the systems to ensure benefits for the current generation with hopes that overall health will increase climate resilience. Therefore, they are addressing current threats like invasive species, forest and stream connectivity, disease and water quality and quantity. These goals are often accomplished through best management practices for forest health, stormwater management and floodplain management. Forest managers are also adjusting management decisions based on expected impacts of climate change on tree species, e.g., some foresters are no longer including the use of trees more commonly found in more northern environments given their expected shift northward. There is also a concern that the focus of addressing climate-related impacts will be primarily on coastal impacts, to the detriment of upland areas. Further discussion on the perceptions of watershed associations can be found within the stakeholder report for the “Water Resources” sector.

### *Coastal Ecosystems*

Stakeholders who work to manage and conserve coastal habitats and associated species are especially concerned about sea level rise. Coastal habitats (salt marshes, maritime forests, beaches and dunes) can provide a variety of ecosystem services, including habitat for key species, improving water quality and absorbing floodwaters – thus also playing a key role in reducing risks to coastal communities. Sea level rise, and associated coastal erosion, is very visible to those who have been living and working around these habitats for decades – it is estimated that marshes in the Delaware Bay are disappearing at a rate of an acre a day<sup>6</sup> – so there is serious concern about projected loss of critical coastal habitats and how

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<sup>6</sup> Kreeger, Danielle. Personal Communication, 8/29/13. Derived from *Technical Report for the Delaware Estuary & Basin*. 2012. P. Cole and D. Kreeger (eds.), Partnership for the Delaware Estuary. Report No. 12.01. 1-255 pp.

this will impact surrounding human communities. For example, they want to better understand how sea level rise will impact marsh habitat, the surrounding uplands and coastal impoundments managed for waterfowl. Will a marsh actually migrate inland or will it just turn into open water? What is the return on investment for protecting critical coastal habitats from an ecosystem services perspective? Further discussion on the perceptions of coastal communities as a whole can be found within the stakeholder report for the “Coastal Communities” sector.

### *Hunting, Angling and Commercial Fishing*

The stakeholder outreach process sought to include representatives of the hunting, recreational and commercial fishing communities. While representatives of the hunting community did not respond to the survey or interview requests, recreational and commercial fishermen did provide their viewpoints via the survey and interviews. Both recreational and commercial fishermen are concerned about how change in water temperature – both fresh and salt water – and salinity will impact the distribution of species important to their particular sector. For example, freshwater anglers are concerned about potential temperature changes on high value trout streams. They are also concerned about climate-related impacts, especially an increase in water temperature, on coastal estuaries that are key to the life cycle of important fisheries.

Saltwater fishermen, both commercial and recreational, have observed a northerly shift of species in the region, like mackerel and sea bass. These shifts, while not fully understood by managers or fishermen (e.g., are they permanent?), require fishermen to travel further for the opportunity to harvest, which has financial and safety implications, and can create management challenges as they cross jurisdictional boundaries (e.g., state-by-state quota cannot be landed in state other than home state.) Finally, shellfish managers and harvesters are concerned about the impact of ocean acidification, increase in water temperatures and salinity changes on oyster and surf clam populations. However, stakeholders are only starting to pay attention to ocean acidification on the East Coasts. Climate impacts are not a top priority for saltwater fishermen; management challenges and retaining access to fishing opportunities through regulations remains a top concern for recreational and commercial fishermen. This may change if fishermen are provided a means to fully understand and take actions address the problems facing marine ecosystems.

### *Experiences Related to Hurricane Sandy*

A majority (89%) of survey respondents experienced impacts to the resources they manage, conserve or harvest during Hurricane Sandy. The most common impacts were flooding, mostly severe, along the coasts, property damage and tree damage due to wind. While there was severe coastal erosion on some areas of the coast, in other areas beaches benefited from the movement of sand along the Atlantic Coast and Delaware Bay, improving habitat conditions. In addition to direct impacts on ecosystems, flora and fauna, many stakeholders,

especially those who work in the coastal environment, saw the benefit of coastal habitats to reducing flooding and damage to coastal communities, highlighting the need to protect and restore key coastal habitats. Finally, some stakeholders would like a mechanism that would allow for a strong voice in the discussions relating to recovery/restoration so that human and wildlife/habitat needs are more balanced.

## **Stakeholders Perceptions of Sector Preparedness**

Overall, natural resources stakeholders believe that the sector does not fully understand how climate change will impact ecosystems, flora and fauna throughout the state and, therefore, is severely underprepared to adapt to those changes. There is great concern over the uncertainty of the impacts, as well as the lack of a coordinated response to climate change (e.g., a statewide climate adaptation plan).

Common stakeholder obstacles to planning and preparing for climate change impacts include the lack of adequate, dedicating funding for resource management and protection and the perceived lack of leadership at the state level. This latter concern was expressed by nongovernmental organizations and other non-state partners who believe that the “rank and file” at NJ DEP are doing the best they can within the limited framework set out by leadership. While there are a variety of statutes and regulations in New Jersey related to climate change preparedness, some stakeholders believe that there is no active policy engagement or leadership from state government. Implementation is not consistent or in some cases previous actions have been reversed, including participation in the Regional Greenhouse Gas Initiative (which would provide funding support) and implementation of the Global Warming Response Act and the Coastal Area Facility Review Act.

Both surveys revealed that some organizations have taken action to prepare for climate change, but these examples are not widespread across the sector (see attached survey reports). They include the development of emergency preparedness plans for organizations, the implementation of “green infrastructure” projects (e.g., riparian buffers, living shorelines, wetland restoration, porous pavement, etc.), adaptive harvest management plans, water conservation plans and habitat conservation/restoration plans. It is more common that stakeholders are planning for these needed actions, and are in search of the resources and capacity to support their efforts.

### *Ongoing Actions to Improve Science* (not inclusive of all actions)

Through the outreach process, representatives from the state and non-governmental organizations highlighted a variety of studies that NJ DEP is undertaking to help inform future climate-related actions across the natural resources sector. Examples include:

- Developing a Habitat Connectivity Plan, which will include a GIS-based map that identifies and characterizes critical habitat cores and corridors and a guidance

document that recommends conservation actions in areas identified by associated mapping of habitat cores and corridors.

- Assessing the vulnerability of focal New Jersey habitats and keystone species to climate change in order to better inform future management decisions. A follow-up to the assessment will identify specific management actions to help address identified vulnerabilities.
- Updating the State Wildlife Action Plan, which provides a framework for the future conservation of New Jersey's species of greatest conservation need. The update will dovetail in climate considerations.
- Contracting with New Jersey colleges and universities to evaluate flood mitigation strategies. The studies will focus on areas of the state heavily impacted by Superstorm Sandy that may be vulnerable to future flooding<sup>7</sup>.

#### *Leading Practices* (including outside of New Jersey)

Organizations in New Jersey and at the national level are leading a variety of efforts that could be leveraged or considered throughout New Jersey to improve the state's readiness for the impacts of climate. Examples mentioned through the interview process include:

- Rutgers University and NJ DEP developed the "Getting to Resilience" community planning tool<sup>8</sup>. This is an online tool to assist communities to reduce vulnerability and increase preparedness by linking planning, mitigation, and adaptation.
- Rutgers University's Center for Remote Sensing and Spatial Analysis completed a report entitled, "Assessing the Vulnerability of Coastal Habitats to Sea Level Rise<sup>9</sup>," which examines the potential impacts of sea level rise to New Jersey's coastal development and ecosystems.
- Rutgers University's Institute of Marine and Coastal Sciences is conducting a wide variety of research on changes in sea surface temperatures, salinity changes and other impacts of climate change on marine habitats and species.
- Both the Barnegat Bay Partnership and the Partnership for the Delaware Estuary have developed strategic adaptation plans under the Environmental Protection Agency's Climate Ready Estuary Program<sup>10</sup>.
- Sustainable Jersey formed its Climate Adaptation Task Force to help municipalities anticipate and prepare for the impacts of climate change and other natural disasters<sup>11</sup>.

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<sup>7</sup> <http://www.nj.gov/dep/docs/flood/index.html>

<sup>8</sup> <http://www.prepareyourcommunitynj.org/>

<sup>9</sup> <http://crssa.rutgers.edu/projects/coastal/sealevel/>

<sup>10</sup> <http://water.epa.gov/type/oceb/cre/live.cfm>

<sup>11</sup> <http://www.sustainablejersey.com/grants-resources/resources/>

- National wildlife refuges in New Jersey are updating their management plans and including climate considerations.
- The American Littoral Society developed a white paper for Monmouth University's Urban Coast Institute that analyzed ways to improve the Coastal Area Facility Review Act (CAFRA) and coastal zone management rules in order to better manage New Jersey's coastline in the face of climate change and increased coastal development.
- The Georgetown Climate Center provides directory of state and local adaptation plans around the country within its clearinghouse<sup>12</sup>.
- Federal and state partners have developed a National Fish, Wildlife and Plants Adaptation Strategy<sup>13</sup>, which "provides a unified approach for reducing the negative impacts of climate change on fish, wildlife and plants, and the natural systems upon which they depend."
- The U.S. Department of Interior's North Atlantic Landscape Conservation Cooperative is implementing a variety of projects to provide regional-scale scientific information for the conservation of fish and wildlife species, include a Climate Change Vulnerability Index (CCVI)<sup>14</sup> to provide an assessment of species' vulnerability to climate change.
- The State of Delaware established the Sea Level Rise Advisory committee<sup>15</sup> to develop a Sea Level Rise Adaptation Plan. The plan includes an assessment of the state's vulnerability to the impacts of sea level rise and will provide a series of recommendations for policy improvements and best management practices. It will also illustrate which geographic areas or topic areas require more attention or research.
- The U.S. Forest Service is working to improve forest management models to incorporate climate change and has developed a clearinghouse of climate-related information and tools for land managers<sup>16</sup>. NJ DEP is looking to incorporate these models in to the development of future management plans.

## Stakeholder Needs and Recommendations for Sector Preparedness

This outreach effort revealed an extensive list of needs and recommendations to improve climate preparedness in the natural resources sector, many focused on funding and state leadership. In the August 2013 survey, the highest priority action, as measured by the number of respondents choosing it as a high need, is support for habitat restoration projects to enhance resiliency and survival of endangered and threatened species and critical

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<sup>12</sup> <http://www.georgetownclimate.org/adaptation/clearinghouse>

<sup>13</sup> National Fish, Wildlife and Plants Climate Adaptation Partnership. 2012. National Fish, Wildlife and Plants Climate Adaptation Strategy. Washington, DC. <http://www.wildlifeadaptationstrategy.gov/>

<sup>14</sup> <http://www.northatlanticlcc.org/projects>

<sup>15</sup> <http://www.dnrec.delaware.gov/coastal/Pages/DESLRAdvisoryCommittee.aspx>

<sup>16</sup> <http://www.fs.fed.us/ccrc/>

habitat, which was selected as a “high need” by 25 (93%) respondents. Development of conservation/restoration plans for at-risk coastal ecosystems was also identified as a high priority, with 21 (84%) respondents selecting it as a high need. Through the Land Conservation Rally survey, incentive programs to preserve climate resilient open space and farmland were identified as one of the highest priority needs at the local, state, or federal level, with 75% of respondents selecting this as a ‘high need’. Please see the attached survey reports for additional information.

Through the interview process, several other needs and recommendations were discussed. There is an overarching need for additional funding to support current and future efforts across the sector, including needed science and research, planning and implementation of on-the-ground projects, incentives for the protection of open space and floodplains (Green Acres and Blue Acres) and protection of endangered and non-game species. A repeated recommendation from stakeholders was for the state to re-engage in the Regional Greenhouse Gas Initiative (RGGI), which would provide a source of funding for climate-related efforts.

While there are some efforts underway to better understand the impacts of climate change on ecosystems, flora and fauna throughout the sector, there is a common sentiment from non-governmental organizations and some federal partners that the state should take more of a leadership role in recognizing and addressing climate-related needs. The state could lead by ensuring that the necessary science is identified and attained in a coordinated fashion; that an appropriate statewide adaptation plan is developed; and that stakeholders are moving forward in a coordinated fashion to address climate risks and impacts. This leadership and support would permeate through actions across the state and help to ensure that partners who are working on private, state and federal lands and managing or protecting species are all working off of the same information and towards a common set of goals. Ideally it would also lead to more capacity and funding on these issues.

Some specific stakeholder recommendations (and potential leads) mentioned in both the surveys, interviews and during the December 2011 workshop include, but are not limited to:

#### *Planning and Policy*

- A statewide climate change response/adaptation plan to provide a guiding framework for actions throughout the state and support for projects to enhance resiliency of natural and human communities and better ensure survival of ecosystems, flora and fauna. As part of this effort, there needs to be a common definition of “climate resilience” and “adaptation,” as well as an established planning horizon (i.e., how many feet of sea level rise should we plan for in coming decades.) [State]
- Regional conservation/restoration plans for at-risk coastal areas to create a unified vision as to what the coast should look like in 50-100 years in the face of sea level

rise. This would allow the state, local governments and non-governmental partners to plan accordingly, especially as storms become more frequent and intense. The stakeholders also expressed a need for greater coordination between partners and the state for coastal adaptation projects. [State or Planning Associations]

- Full implementation of the Global Warming Response Act, which effectively requires the inclusion of climate change impacts in state decision-making, an updated Energy Master Plan with a 30% renewable energy goal. [State]
- Ensure that federal and state fishery management plans are adaptive and take shifting populations into account (e.g., allow for landing of harvest in different states) and allow management to adjust accordingly. However, some fishermen caution that managers need to be careful to not be too reactive until they fully understand if the population shifts are permanent. [Federal and state fishery managers]
- Water supply planning and conservation plans that account for a changing climate, e.g., updated Water Supply Master Plan. [State]
- A more robust State Development and Redevelopment Plan that takes climate change into account. [State]
- A means to better inform local governments about climate risks so they will take more responsible actions to mitigate risks and connect community planning, like hazard mitigation plans, with conservation. Related to this, stakeholders would also like to see more tools that allow regional and municipal governments and non-governmental organizations to move forward with responding to climate change impacts in the absence of leadership at the state level. [Academia]
- Development of incentives and regulatory mechanisms for organizations to more easily improve health of watersheds and ecosystems. [State]
- A compilation of best practices on how to better manage the built environment when trying to create habitat corridors for species migration. [Academia]

### *Research and Science*

- In general, research and science efforts need to be coordinated to ensure needs are being met, and to enhance partnerships and reduce duplicative efforts.
- Research and data to fully understand the impacts of climate change to be able to plan accordingly in both upland and coastal areas. This includes enhanced monitoring to establish baselines and monitor changes to species health, distribution, and other measures that could trigger need for action in the natural resources community. Related to this is the need for improved climate modeling capacity for local-scale assessments. [State and Academia]
- Additional research on the vulnerability of and impacts to recreationally and commercially important saltwater fisheries, including impacts of ocean acidification and rising sea temperatures. Additional research could be funded in-part by the federal research set-aside needs. However, there is also concern that climate-related

funding will take away from the current data needs for effective fisheries management. [Federal]

- Improved science behind “marsh futures” to strategically identify where coastal restoration efforts would provide the best return on investment. [All]
- A robust statewide monitoring plan for climate-related restoration projects, including coastal restoration and living shoreline projects, so lessons-learned can be inter-related. [All]
- The implementation of a cost-benefit analysis related to sea level rise, comparing no-action to strategic retreat. [Academia]
- A sustained mechanism to monitor health of wetlands to better understand where to focus conservation efforts, especially in coastal wetlands. EPA’s Wetland Program Development Grants only allow for protection and projects and do not fund long-term monitoring and the state’s coastal programs do not have the resources to do so. [State and/or Federal]

#### *Coordination, Outreach and Education*

- Improved coordination and training between the conservation community and regional, state and federal resources agencies regarding climate change issues. Federal, state and non-governmental partners need to focus on better developing wholesale partnerships and collaboration about planning and implementation. Some regional planning bodies are addressing climate issues, but those attempts can be very specific and more partnerships at different scales need to be developed. [All]
- Concerted public outreach and education campaign to create public will to act at the individual level. Stakeholders would like to see partners across the state, led by the state, talking to the public about impacts on human populations and natural resources and actions they can take to help. [All]

#### *Near-Term Policy Initiatives to Enhance Sector Preparedness*

While this effort was to establish policy recommendations for improving climate preparedness, there was equal focus from stakeholders regarding science needs. A few near-term initiatives include:

- Establishing a framework for the development of a statewide climate response/adaptation plan that addresses both coastal and upland issues. Included would be the creation of a coastal development plan to plan for strategic retreat from the most vulnerable coastal areas.
- Review of CAFRA and the coastal-related regulations to identify ways in which to improve coastal preparedness to sea level rise and extreme storm events by either closing loopholes or better implementation. A few stakeholder groups have

conducted reviews in the past and could provide a foundation for a comprehensive, cross-sector evaluation.

- Development of a common set of research and science priorities for upland and coastal ecosystems, flora and fauna.

### **Insights from the Author**

During the outreach process, perhaps the most repeated comment from stakeholders outside of state government is the desire and need for guidance from leadership at the state level. All of the stakeholders, including different divisions and bureaus within DEP, are working to assess climate risks and impacts and how to best adapt. However, a majority of those surveyed and interviewed want to ensure that their work is contributing towards a common statewide goal. Without strategic direction from leadership within NJDEP and the governor's office, many stakeholders believe that the state will never make significant progress towards climate readiness.

Additional short-term priority actions that could be undertaken are related to updating state plans, e.g., State Strategic Plan, State Water Supply Plan, etc. While many stakeholders have provided comments to the state regarding their concerns, consideration could be given to determining which aspects of these plans can be promoted outside of a typical government frame work. Consideration should also be given to developing a common set of policy reforms to bring to state leadership regarding these plans.

Finally, it was clear from the stakeholder outreach that an increase in partnerships across the state in order to leverage resources and capacity is strongly desired. The New Jersey Climate Adaptation Alliance could play a role in facilitating those partnerships, whether they be policy or science-based.

## Appendices

*Appendix A: Natural Resources Stakeholder Survey Questions*

Preparing for Climate Change Impacts in New Jersey: Natural Resource Managers

Q1 Please read the following information and sign electronically in the box below, indicating your informed consent. Thank you for agreeing to participate in this online survey. This research is being conducted by Rutgers University in conjunction with the New Jersey Climate Adaptation Alliance. Leaders representing and serving New Jersey's natural resource areas are being asked to participate. The purpose of the survey is to obtain data to assess New Jersey's most pressing concerns resulting from climate change as they affect natural resources, and to help to prioritize a set of program, planning and policy adaptations that are necessary to prepare for and mitigate these impacts. There are no reasonable or discernible risks to your participation in this study. We are not asking for your name on the survey, and will only utilize information collected in summary form to categorize or further explain important differences. If we are able to deduce your identity, the research will be confidential. Confidential means that the research records will include some information about you and this information will be stored in such a manner that there is some linkage between your identity (as deduced but not specified) and the response in the research. The information collected about you includes your opinions about climate change risks, ratings of concern about climate change impacts and your assessment of the needs for various climate adaptation programs. Please note that we will keep this information confidential by not including your name in the data records, limiting individual access to the research data and keeping it in a secure location. The research team and the Institutional Review Board (a committee that reviews research studies in order to protect research participants) at Rutgers are the only parties that will be allowed to see the data, except as may be required by law. If a report of this study is published, or the results are presented at a professional conference, only group results will be stated. All study data will be kept for three years. The benefits of completing the survey are that you will contribute to further knowledge and insight about impacts to New Jersey from climate change and help to inform the development and prioritization of resources needed to support new or expanded programs or policies to address these impacts. The survey should take about 10-15 minutes to complete. Participation is completely voluntary and refusal to participate will result in no penalties. You may opt out of completion of the survey at any time while taking it. If you have questions related to the research, please contact Jeanne Herb, Associate Director of the Environmental Analysis and Communication group, 33 Livingston Ave., New Brunswick, NJ 08901, 848-932-2725, [jherb@ejb.rutgers.edu](mailto:jherb@ejb.rutgers.edu). If you have questions about your rights as a research subject, you may contact the IRB Administrator at Rutgers University at:

Institutional Review Board for the Protection of Human Subjects  
Research and Sponsored Programs  
NJ08901-8559  
0150

3 Rutgers Plaza  
Tel: 838 932  
Email: [humansubjects@orsp.rutgers.edu](mailto:humansubjects@orsp.rutgers.edu)

Rutgers University  
Office of  
New Brunswick,

- I have read and understand the risks and benefits of this research and agree to participate by typing my initials in this box. \_\_\_\_\_

Q2 For the purposes of this survey, “natural resource management” is defined as the management or protection of ecosystems and/or species (game, non-game or endangered), or the commercial or recreational harvest of species across New Jersey. What best describes your interest in natural resource management in New Jersey?

- Land Manager / Protection
- Species Manager / Protection
- Administrator / Regulator
- Attorney
- Scientist
- Other \_\_\_\_\_
- Land Manager
- Species Manager / Protection
- Coastal Habitat Manager / Protection
- Administrator / Regulator
- Funder
- Other \_\_\_\_\_
- Recreational Fishing
- Commercial Fishing
- Commercial Shellfish Harvest
- Hunting
- Other \_\_\_\_\_
- General Interest / Citizen

Q3 If you work in government, check which level of government applies to you.

- Municipal
- County
- State
- Federal

Q26 If you work in government or for an NGO, for which municipality, county, or area do you manage resources?

Q5 Do you work in New Jersey?

- Yes
- No

Q6 Do you live in New Jersey?

- Yes
- No

Q5 Do you Strongly Agree, Agree, Disagree or Strongly Disagree (or Don't Know) with the following statements?

|   | Strongly Agree        | Agree                 | Disagree              | Strongly Disagree     | Don't Know            |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Global climate change is not occurring.   | <input type="radio"/> |
| Global climate change is mostly caused by human activity.                                       | <input type="radio"/> |
| Global climate change is a risk to New Jersey.  | <input type="radio"/> |
| Global climate change is a risk to me, my family, and my friends.                               | <input type="radio"/> |
| The international scientific community understands the science behind global climate change.    | <input type="radio"/> |
| I trust the scientific community to truthfully report their findings related to climate change. | <input type="radio"/> |

|   |                       |                       |                       |                       |                       |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <p>Our state and local officials understand the implications of global climate change for my region.</p> <p>The media I rely on communicate honestly with us about global climate change.</p> | <input type="radio"/> |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|

Q6 Please rate how concerned you are about the following climate change-related impacts to natural resource management: IMPACTS RELATED TO WATER (pertains to fresh, tidal, and marine systems)

|   | Great Concern         | Some Concern          | Little Concern        | No Concern            | Not applicable        |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Higher water temperatures                     | <input type="radio"/> |
| Increased algal blooms / eutrophication       | <input type="radio"/> |
| Reduced aquatic flow                          | <input type="radio"/> |
| Reduced water availability                    | <input type="radio"/> |
| Increased sediment volumes                    | <input type="radio"/> |
| Salinity changes to water resources           | <input type="radio"/> |
| Concentration of pollutants in water          | <input type="radio"/> |
| More and longer droughts                      | <input type="radio"/> |
| Increased occurrence and severity of flooding | <input type="radio"/> |
| Reduced flood attenuation                     | <input type="radio"/> |
| Acidification of marine waters                | <input type="radio"/> |

Q7 IMPACTS RELATED TO LAND

|                                     | Great Concern         | Some Concern          | Little Concern        | No Concern            | Not applicable        |
|-------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Soil erosion / loss                 | <input type="radio"/> |
| Soil compaction                     | <input type="radio"/> |
| Concentration of pollutants in soil | <input type="radio"/> |
| Reduced carbon storage              | <input type="radio"/> |
| Reduced water filtration            | <input type="radio"/> |
| Reduced air purification            | <input type="radio"/> |
| Beach/dune loss                     | <input type="radio"/> |
| Tidal wetland erosion/loss          | <input type="radio"/> |
| More wildfires                      | <input type="radio"/> |

Q8 IMPACTS RELATED TO FLORA, FAUNA, AND PEOPLE

|  | Great Concern         | Some Concern          | Little Concern        | No Concern            | Not applicable        |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Changes in plant and animal species composition and distribution             | <input type="radio"/> |
| Species life cycle changes (e.g. bloom time, reproductive timing)            | <input type="radio"/> |
| Increased spread of invasive species   | <input type="radio"/> |
| Increased occurrence / spread of pathogens, pests, and vector-borne diseases | <input type="radio"/> |
| Critical species habitat loss  | <input type="radio"/> |
| Salinity impacts on vegetation   | <input type="radio"/> |
| Heat stress / stroke (for recreationalists and workers)                      | <input type="radio"/> |
| Reduced recreation and tourism   | <input type="radio"/> |
| Increased costs and risks associated with fisheries changes                  | <input type="radio"/> |

Q24 Were the natural resources you are responsible for or harvest, and/or associated infrastructure, impacted by Tropical Storm Irene (2011)?

- Yes
- No
- n/a

Q11 If yes, in what ways? Select all that apply:

- Minor flooding
- Severe flooding
- Short term land/property damage
- Long term or permanent land/property damage
- Short term species impacts
- Long term species impacts
- Other \_\_\_\_\_

Q12 Were the natural resources you are responsible for or harvest, and/or associated infrastructure, impacted by Hurricane Sandy (2012)?

- Yes
- No
- n/a

Q13 If yes, in what ways? Select all that apply:

- Minor flooding
- Severe flooding
- Short term land/property damage
- Long term or permanent land/property damage
- Short term species impacts
- Long term species impacts
- Other \_\_\_\_\_

Q28 Of the following climate change adaptations, which are in place, planned, or needed for your program/properties/activities?

|  | In Place              | Planned               | Not Planned but Needed | Not Needed            | Don't Know            | Not Applicable        |
|--|-----------------------|-----------------------|------------------------|-----------------------|-----------------------|-----------------------|
| Property vulnerability assessments   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Natural resource vulnerability assessments   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Risk maps  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Emergency preparedness plans   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Protection of representative ecosystems of sufficient size   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Protection of connective corridors between ecosystems  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Collaborative regional approaches to manage ecosystems and/or species to respond to climate change | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

|  |                       |                       |                       |                       |                       |                       |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Green infrastructure (e.g. riparian buffers, living shorelines, native landscaping, tree planting, wetland restoration, porous pavement, etc.) | <input type="radio"/> |
| Surveillance for diseases  | <input type="radio"/> |
| Adaptive harvest management plans  | <input type="radio"/> |
| Water conservation plans   | <input type="radio"/> |
| Habitat conservation / restoration plans   | <input type="radio"/> |
| Other  | <input type="radio"/> |

Q15 What are the most important actions or programs needed at the regional, state, or federal level to support the natural resources community in preparing for and responding to climate change impacts?

|  | High Need             | Some Need             | Little or No Need     | Don't Know            |
|--|-----------------------|-----------------------|-----------------------|-----------------------|
| Enhanced monitoring to establish baselines and monitor changes to species health, distribution, and other measures that could trigger need for action in the natural resources community | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Enhanced vector and disease surveillance programs  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Development of conservation/restoration plans for at-risk coastal ecosystems   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Improved climate modeling capacity for local scale assessments   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Development of land conservation targets based on likely climate change scenarios  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Improved coordination and training between the conservation community and regional, state, and federal resource agencies regarding climate change issues                                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Research on the vulnerability of and impacts to commercially important fisheries species and development of plans to adaptively manage species   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

|  |                       |                       |                       |                       |
|--|-----------------------|-----------------------|-----------------------|-----------------------|
| Research on the vulnerability of and impacts to recreationally important species (hunting and fishing) and development of plans to adaptively manage species | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Enhanced conservation practices to reduce stormwater runoff  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Coordination and action among fishery management councils to address potential shift in distribution of marine fisheries                                     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Incentive programs to preserve open space and farmland   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Water supply planning and conservation programs that account for a changing climate  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Support for habitat restoration projects to enhance resiliency and survival of endangered and threatened species and critical habitat                        | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Development and implementation of appropriate fire management strategies in at-risk forested areas   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Other  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Q29 What does your natural resource management program most need to prepare for and be ready to respond to climate change impacts over the coming decades?

Q17 What are the biggest challenges to achieving preparedness for climate change?

Q30 How do you view those challenges compared to other concerns you deal with?

Q31 What are some actions you have already taken to address climate change preparedness in your programs/activities?

Q18 Please rank climate change impacts in importance among these non-climate stressors to natural resource management. (Drag and drop to rank 1 to 6 with 1 being most important and 6 being least important):

- \_\_\_\_\_ Climate Change Impacts
- \_\_\_\_\_ Encroaching Land Development
- \_\_\_\_\_ Increases in Pollution
- \_\_\_\_\_ Alterations to Hydrology (channelization, etc.)
- \_\_\_\_\_ Overuse of Trails / Multi Use Conflicts
- \_\_\_\_\_ Regulations to Restrict Harvest

## *Appendix B: Summary of Natural Resources Stakeholder Survey Results*

### **Preparing for Climate Change Impacts in New Jersey**

#### **Summary of Natural Resources Survey:**

Administered to representatives of the natural resource management community, defined as those involved in the management or protection of ecosystems and/or species, or the commercial or recreational harvest of species across New Jersey.

Survey conducted online August 15 – September 5, 2013.

#### *Overview of Participants*

27 respondents completed this online survey. Of the respondents, 6 respondents (23%) work in government, 13 respondents (50%) work for non-governmental organizations, and 6 respondents (23%) are resource users. Respondents' roles include habitat, land, and species managers (14 respondents), recreational fisherman (4 respondents), as well as a funder, regulator, attorney, scientist, and commercial fisherman. Twenty-five of the respondents work in New Jersey and 24 live in New Jersey.

#### *Views on Climate Change*

Respondents were asked whether they agree, strongly agree, disagree, or strongly disagree with the statement “Global climate change is not occurring.” Twenty-six (96%) of the respondents believe climate change is occurring, with 23 of the respondents strongly disagreeing and 3 disagreeing with this statement, while 1 respondent strongly agreed with the statement.

The majority of respondents (21, or 78%) believe that climate change is mostly caused by human activity. All 27 respondents (100%) agreed or strongly agreed with the statement “Climate change is a risk to New Jersey”, and 92% think climate change is a personal risk to family and friends. Most respondents (21/78%) agree that the international scientific community understands the science behind climate change, while 19% (5 respondents) disagree or strongly disagree and 1 responded ‘don’t know’. 85% (23 respondents) trust the scientific community to truthfully report their findings related to climate change. Confidence in public officials is low, with only 1 respondent agreeing that “state and local officials understand the implications of global climate change for my region”, 24 (89%) disagreeing or strongly disagreeing, and 2 responding “don’t know”. Trust in the media is mixed, with 12 (45%) agreeing the media communicate honestly about global climate change and 14 (52%) disagreeing.

#### *Climate Change Impacts*

The survey presented a range of climate change impacts and respondents were asked to rank whether each impact was of great concern, some concern, little concern, or no concern. For every impact presented, a majority of respondents selected either ‘some’ or ‘great’ concern.

Respondents overall had the greatest concern about increased occurrence and severity of flooding (25 respondents, or 93%, selected ‘great concern’), and loss of critical species habitat (85% ‘great concern’). Other major concerns included loss and erosion of tidal wetlands (80%), loss of beaches and dunes (79%), higher water temperatures (70%), increased spread of invasive species (70%), increased occurrence/spread of pathogens, pests, and vector-borne diseases (67%), increased algal blooms/eutrophication (58%), and changes in plant and animal species compositions and distribution (56%).

### *Impacts from Irene and Sandy*

The natural resource areas of 20 respondents (80%) were impacted by Tropical Storm Irene in 2011, with common impacts including short-term land and property damage (70%) and severe flooding (65%).

The natural resource areas of 24 respondents (89%) were affected by Hurricane Sandy in 2012. Common impacts included severe flooding (71%), short-term and long-term land and property damage (71% and 54% respectively), and short and long-term species impacts (46% and 42%).

### *Climate Change Adaptation and Preparedness Activities*

Several of the climate change adaptation actions listed in the survey are already in place or planned in several natural resource managers’ jurisdictions. Of the options presented, emergency preparedness plans are the most common (8 in place, 5 planned), followed by green infrastructure (6 in place, 9 planned), habitat conservation and restoration plans (5 in place, 9 planned) and risk maps (3 in place, 10 planned).

Major needs identified, as measured by the number of respondents reporting that the activity is not planned but needed, include collaborative regional approaches to manage ecosystems and species to respond to climate change (15), protection of representative ecosystems of sufficient size (14), natural resource vulnerability assessments (13), property vulnerability assessments (12), protection of connective corridors between ecosystems (12), and water conservation plans (11).

Survey respondents were also asked what actions they have already taken to address climate change in their programs and activities. Responses included education and awareness building programs, acquisition of coastal land, development of coastal planning tools, and conducting an infrastructure assessment and baseline data collection.

### *Policy Priorities*

Respondents were asked “what are the most important actions or programs needed at the regional, state, or federal level to support local emergency managers in preparing for and responding to climate change impacts?” and asked to rank each in a list of options as ‘high need’, ‘some need’, or ‘little or no need’. There were several actions or programs presented that

100% of respondents indicated a need for (i.e. 100% of respondents selected either “high need” or “some need”). The highest priority action, as measured by the number of respondents choosing it as a high need, is support for habitat restoration projects to enhance resiliency and survival of endangered and threatened species and critical habitat, which was selected as a “high need” by 25 (93%) respondents. Development of conservation/restoration plans for at-risk coastal ecosystems was also identified as a high priority, with 21 (84%) respondents selected it as a high need.

Other priority actions at the regional, state, or federal level that respondents nearly unanimously agreed are needed include enhanced conservation practices to reduce stormwater runoff (21 respondents view as a high need), water supply planning and conservation programs that account for a changing climate (20), improved coordination and training between the conservation community and regional, state, and federal resource agencies (19), incentive programs to preserve open space and farmland (18), enhanced monitoring to establish baselines and monitor changes to species health and distribution (18), development of land conservation targets based on likely climate change scenarios (17), research on the impacts to commercially important fisheries species and development of adaptive management plans (17), and improved climate modelling capacity for local scale assessments (16).

### *Critical Needs*

When asked “what does your natural resource management program most need to prepare and be ready to respond to climate change impacts over the coming decades”, responses focused on the need for better baseline data and improved modelling to project climate change impacts. Responses included “good local predictive models”, “support for baseline monitoring and local scale modeling”, and “better baseline data and improved modelling”. Other responses included “increased personnel and streamlining of regulatory and management processes” and “coordination with state government in coastal adaptation projects”.

### *Challenges*

Challenges identified by natural resource managers to achieving preparedness for climate change in New Jersey include lack of funding, difficulty in modelling, especially at the local scale, and better understanding of the causes and impacts of climate change.

### *Issue Prioritization*

When presented with a list of five natural resource management concerns and asked to rank them in order of importance, with 1 being most important and 5 being least important, the average rank order selected was 1) Encroaching Land Development; 2) Climate Change Impacts; 3) Alterations to Hydrology; 4) Regulations to Restrict Harvest; and 5) Overuse of Trails/Multi-Use Conflicts, with land development and climate change clearly the priority issues.

*Appendix C: Land Trust Rally Survey Questions*

Climate Change Preparedness in New Jersey: Land Trust Rally Participants

Q1 Please read the following information and sign electronically in the box below, indicating your informed consent. Thank you for agreeing to participate in this online survey. This research is being conducted by Rutgers University, in conjunction with the New Jersey Climate Adaptation Alliance. All participants from the 2013 New Jersey Land Conservation Rally are being asked to participate. The purpose of the survey is to obtain data to assess New Jersey's most pressing land conservation and farmland preservation concerns resulting from climate change, and to help to prioritize a set of program, planning and policy adaptations that are necessary to prepare for and mitigate these impacts. There are no reasonable or discernible risks to your participation in this study. We are not asking for your name on the survey, and will only utilize information collected in summary form to categorize or further explain important differences. If we are able to deduce your identity, the research will be confidential. Confidential means that the research records will include some information about you and this information will be stored in such a manner that there is some linkage between your identity (as deduced but not specified) and the response in the research. The information collected about you includes your opinions about climate change risks, ratings of concern about climate change impacts and your assessment of the needs for various climate adaptation programs. Please note that we will keep this information confidential by not including your name in the data records, limiting individual access to the research data and keeping it in a secure location. The research team and the Institutional Review Board (a committee that reviews research studies in order to protect research participants) at Rutgers are the only parties that will be allowed to see the data, except as may be required by law. If a report of this study is published, or the results are presented at a professional conference, only group results will be stated. All study data will be kept for three years. The benefits of completing the survey are that you will contribute to further knowledge and insight about impacts to land conservation from climate change and help to inform the development and prioritization of resources needed to support new or expanded programs or policies to address these impacts. The survey should take about 10-15 minutes to complete. Participation is completely voluntary and refusal to participate will result in no penalties. You may opt out of completion of the survey at any time while taking it. If you have questions related to the research, please contact Jeanne Herb, Associate Director of the Environmental Analysis and Communication group, 33 Livingston Ave., New Brunswick, NJ 08901, 848-932-2725, [jherb@ejb.rutgers.edu](mailto:jherb@ejb.rutgers.edu). If you have questions about your rights as a research subject, you may contact the IRB Administrator at Rutgers University

at: Rutgers University Institutional Review Board for the Protection of Human  
Subjects Office of Research and Sponsored Programs 3 Rutgers  
Plaza New Brunswick, NJ 08901-8559 Tel: 838 932  
0150 Email: [humansubjects@orsp.rutgers.edu](mailto:humansubjects@orsp.rutgers.edu)

I have read and understand the risks and benefits of this research and agree to participate by typing my initials in this box. \_\_\_\_\_

Q2 What BEST describes your interest in open space and farmland in New Jersey. Select one:

- Government Land Manager
- Land Manager for Nonprofit Organization
- Educator
- Private Property Owner
- Consultant
- General Interest/Citizen
- Local Volunteer
- Other \_\_\_\_\_

Q3 Do you work in New Jersey?

- Yes
- No

Q4 Do you live in New Jersey?

- Yes
- No

Q5 Do you Strongly Agree, Agree, Disagree or Strongly Disagree (or Don't Know) with the following statements?

|   | Strongly Agree        | Agree                 | Disagree              | Strongly Disagree     | Don't Know            |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Global climate change is not occurring.   | <input type="radio"/> |
| Global climate change is mostly caused by human activity.                                       | <input type="radio"/> |
| Global climate change is a risk to New Jersey.  | <input type="radio"/> |
| Global climate change is a risk to me, my family, and my friends.                               | <input type="radio"/> |
| The international scientific community understands the science behind global climate change.    | <input type="radio"/> |
| I trust the scientific community to truthfully report their findings related to climate change. | <input type="radio"/> |

|   |                       |                       |                       |                       |                       |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <p>Our state and local officials understand the implications of global climate change for my region.</p> <p>The media I rely on communicate honestly with us about global climate change.</p> | <input type="radio"/> |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|

Q6 Please rate how concerned you are about the following climate change related impacts to open space and farmland:      IMPACTS RELATED TO WATER

|   | Great Concern         | Some Concern          | Little Concern        | No concern            | Not applicable        |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Higher water temperature                      | <input type="radio"/> |
| Increased algal blooms/eutrophication         | <input type="radio"/> |
| Reduced aquatic flow                          | <input type="radio"/> |
| Reduced water availability                    | <input type="radio"/> |
| Increased sediment volumes                    | <input type="radio"/> |
| Salinity changes to water resources           | <input type="radio"/> |
| Concentration of pollutants in water          | <input type="radio"/> |
| More and longer droughts                      | <input type="radio"/> |
| Increased occurrence and severity of flooding | <input type="radio"/> |
| Reduced flood attenuation                     | <input type="radio"/> |

Q7 Please rate how concerned you are about the following climate change related impacts to open space and farmland:      IMPACTS RELATED TO LAND AND AIR

|                                     | Great Concern         | Some Concern          | Little Concern        | No concern            | Not applicable        |
|-------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Soil erosion/loss                   | <input type="radio"/> |
| Soil compaction                     | <input type="radio"/> |
| Concentration of pollutants in soil | <input type="radio"/> |
| Reduced carbon storage              | <input type="radio"/> |
| Reduced water filtration            | <input type="radio"/> |
| Reduced air purification            | <input type="radio"/> |
| Beach/dune loss                     | <input type="radio"/> |
| Tidal wetland erosion/loss          | <input type="radio"/> |
| More wildfires                      | <input type="radio"/> |

Q8 Please rate how concerned you are about the following climate change related impacts to open space and farmland: IMPACTS RELATED TO FLORA, FAUNA AND PEOPLE

|  | Great Concern         | Some Concern          | Little Concern        | No Concern            | Not applicable        |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Changes in plant and animal species composition and distribution       | <input type="radio"/> |
| Species lifecycle changes (e.g., bloom time, reproductive timing)      | <input type="radio"/> |
| Increased spread of invasive species                                   | <input type="radio"/> |
| Increased occurrence/spread of pathogens, pests, vector-borne diseases | <input type="radio"/> |
| Critical species habitat loss  | <input type="radio"/> |
| Salinity impacts on vegetation   | <input type="radio"/> |
| Heat stress/stroke (for visitors and workers)                          | <input type="radio"/> |
| Reduced recreation and tourism   | <input type="radio"/> |

Q9 Please rate how concerned you are about the following climate change related impacts to open space and farmland: IMPACTS RELATED TO FARMLAND

|                                  | Great Concern         | Some Concern          | Little Concern        | No Concern            | Not applicable        |
|----------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Salinity impacts on crops        | <input type="radio"/> |
| Crop damage/loss                 | <input type="radio"/> |
| Reduced crop yield               | <input type="radio"/> |
| Reduced livestock production     | <input type="radio"/> |
| Loss of soil fertility           | <input type="radio"/> |
| Unsuitability for crop varieties | <input type="radio"/> |
| Increased water demand for crops | <input type="radio"/> |
| Reduced growing season           | <input type="radio"/> |
| Delayed spring planting          | <input type="radio"/> |
| More root disease                | <input type="radio"/> |

Q10 Were the open spaces/farmlands you are responsible for impacted by Tropical Storm Irene (2011)?

- Yes
- No
- Not Applicable

Q11 If the open spaces/farmlands you are responsible for were affected by Tropic Storm Irene, what were the types of impacts?

- Severe flooding
- Minor flooding
- Short term land/property damage
- Long term or permanent land/property damage
- Resident or livestock evacuation
- Other \_\_\_\_\_

Q12 Were the open spaces/farmlands you are responsible for impacted by Hurricane Sandy (2012)?

- Yes
- No

Q13 if the open spaces/farmlands you are responsible for were affected by Hurricane Sandy, what were the types of impacts?

- Severe flooding
- Minor flooding
- Short term land/property damage
- Long term or permanent land/property damage
- Resident or livestock evacuation
- Other \_\_\_\_\_

Q14 Of the following climate change adaptations, which are In Place, Planned or Needed for YOUR program or properties?

|   | In Place              | Planned               | Not Planned but Needed | Not Needed            | Don't Know            | Not Applicable        |
|---|-----------------------|-----------------------|------------------------|-----------------------|-----------------------|-----------------------|
| Property and resource vulnerability assessments   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Risk maps   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Emergency preparedness plans  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Protection of representative ecosystems of sufficient size  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Protection of connective corridors between ecosystems   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Collaborative regional approaches to manage ecosystems to respond to climate change   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Green infrastructure (e.g., riparian buffers, living shorelines, native landscaping, tree planting, wetland restoration, porous pavement, etc.) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Surveillance for diseases   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

|  |                       |                       |                       |                       |                       |                       |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Livestock shelters   | <input type="radio"/> |
| Water conservation (e.g., drip irrigation, water efficiency, change to less water intensive crops) | <input type="radio"/> |
| Crop diversification   | <input type="radio"/> |
| Altered farm practices (e.g., mulching, intercropping)   | <input type="radio"/> |
| Moving of livestock to irrigated pastures earlier  | <input type="radio"/> |
| Drilling new wells or seeking alternative water sources  | <input type="radio"/> |
| Pumping of more water  | <input type="radio"/> |
| Farmscaping for biodiversity, pollination, pest and flood control                                  | <input type="radio"/> |
| Other  | <input type="radio"/> |
| Other  | <input type="radio"/> |

Q15 What are the most important actions or programs needed at the REGIONAL, STATE, OR FEDERAL levels to support efforts by members of the open space and farmland preservation community to prepare for and respond to climate change impacts?

|  | High Need             | Some Need             | Little or No Need     | Don't Know            | Not Applicable        |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Enhanced monitoring to establish baselines and monitor changes to species health, crop yield and other measures that could trigger a need for action | <input type="radio"/> |
| Enhanced vector and disease surveillance programs  | <input type="radio"/> |
| Development of improved and low-cost weed/vector control approaches  | <input type="radio"/> |
| Improved climate modeling capacity for local scale assessments   | <input type="radio"/> |
| Development of land conservation targets based on likely climate change scenarios  | <input type="radio"/> |
| improved coordination and training between the conservation community and regional, state,   | <input type="radio"/> |

|  |   |   |   |   |   |
|--|---|---|---|---|---|
| <p>federal resource agencies regarding climate change issues</p>   |   |   |   |   |   |
| <p>Research on the vulnerability of economically important agricultural species and development of adaptive plant/agricultural species and varieties</p> | ○ | ○ | ○ | ○ | ○ |
| <p>Enhanced Best Management Practices to reduce stormwater runoff</p>  | ○ | ○ | ○ | ○ | ○ |
| <p>Programs to assist property owners in changeover to new equipment or for experimenting with new varieties of climate-resistant crops</p>              | ○ | ○ | ○ | ○ | ○ |
| <p>Incentive programs to preserve climate resilient open space and farmland</p>  | ○ | ○ | ○ | ○ | ○ |
| <p>Water supply planning and conservation programs to account for a changing climate</p>   | ○ | ○ | ○ | ○ | ○ |

|   |                       |                       |                       |                       |                       |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Research on innovative and cost effective strategies for improved water systems management and design                                 | <input type="radio"/> |
| Support for habitat restoration projects to enhance resiliency and survival of endangered and threatened species and critical habitat | <input type="radio"/> |
| Work to identify and implement appropriate fire management strategies in at-risk forested areas                                       | <input type="radio"/> |
| Other   | <input type="radio"/> |
| Other   | <input type="radio"/> |

Q16 What does your open space or farmland preservation program MOST NEED to prepare for and be ready to respond to climate change impacts over the coming decades?

Q17 What are the most biggest challenges to achieving preparedness for climate change in New Jersey?

Q18 Please rank climate change impacts in importance among these non-climate stressors to land and farmland conservation/preservation? (Drag and drop to rank 1 to 6 with 1 being most important and 6 being least important):

- \_\_\_\_\_ Climate Change Impacts
- \_\_\_\_\_ Encroaching Land Development
- \_\_\_\_\_ Increases in Contaminants
- \_\_\_\_\_ Alterations to Hydrology (channelization, etc.)
- \_\_\_\_\_ Introduced or Invasive Species
- \_\_\_\_\_ Overuse of Trails/Multi-use conflicts

## *Appendix D: Summary of Land Trust Rally Survey Results*

**Summary of Land Trust Survey: Preparing for Climate Change Impacts in New Jersey**  
Administered to attendees of the New Jersey Land Conservation Rally on March 9, 2013  
Survey conducted online May 1 – June 12, 2013.

### *Overview of Participants*

35 respondents completed this online survey. Of the respondents, 17% are government land managers, 20% are land managers for nonprofit organizations, 17% are citizens with a general interest in land conservation, and 11% are local volunteers, with the remainder responding “other”.

### *Views on Climate Change*

89% of respondents believe climate change is occurring, with 30 of the respondents strongly disagreeing and 1 disagreeing with the statement “global climate change is not occurring”. 11% do not think that climate change is occurring. The overwhelming majority of respondents (89%) believe that climate change is mostly caused by human activity, with 51% strongly agreeing on this point, 37% agreeing, 6% disagreeing and 6% responding “don’t know”. Nearly all respondents (94%) feel climate change is a risk to New Jersey, and 91% think climate change is a personal risk to family and friends. 80% agree that the international scientific community understands the science behind climate change and 86% trust the scientific community to truthfully report their findings related to climate change. Opinion on the media is divided, with 46% agreeing that the media communicate honestly about global climate change, 31% disagreeing, and 23% responding “don’t know”. Most respondents expressed little faith in state and local officials’ comprehension of climate issues, with 80% disagreeing or strongly disagreeing with the statement “our state and local officials understand the implications of global climate change for my region.”

### *Climate Change Impacts to Open Space and Farmland*

Respondents expressed ‘great concern’ or ‘some concern’ about nearly all of the water-related impacts presented in the survey. More and longer droughts was the issue of the greatest concern, with 97% expressing concern (89% great/8% some). The next most concerning water-related issue was the opposite climate extreme, increased occurrence and severity of flooding (97% overall - 74% great/23% some). Other water issues of major concern include increased algal blooms (97% - 71%/26%) and reduced water availability (94% - 69%/26%).

Tidal wetland erosion and loss was a major concern, with 97% of respondents expressing great (80%) or some (17%) concern about this issue, as was beach and dune loss (91% - 66% great/25% some). 94% of respondents identified critical species habitat loss as a concern, with 69% of respondents expressing great concern and 26% expressing some concern. Species

lifecycle changes such as bloom time and reproductive timing was also a major concern (97% - 60%/37%), as was the risk of changes in plant and animal species composition and distribution (94% - 66%/29%) and an increased spread of invasive species (91% - 63%/29%). Other impacts of concern include reduced water filtration, reduced air purification, reduced carbon storage, and soil erosion and loss.

Of impacts related specifically to farmland, respondents were most concerned about increased water demand for crops (91% - 74% great/18% some), reduced crop yield (91% - 68% great/24% some) and crop damage/loss (94% - 62%/32%).

### *Impacts from Irene and Sandy*

The open lands/farmlands of 81% of respondents were impacted by Tropical Storm Irene in 2011, with common impacts including severe flooding (33%) and short-term land/property damage (33%).

81% of the respondents' open spaces and farmlands were affected by Hurricane Sandy in 2012, with 32% reporting short term land/property damage and 28% reporting long term or permanent land/property damage. Only 12% of respondents reported severe flooding from Hurricane Sandy, compared with 33% from Irene.

### *Climate Change Adaptation and Preparedness Activities*

Very few of the climate change adaptation options listed in the survey were identified as already in place or planned. Of the options presented, emergency preparedness plans are the most common (24% in place, 35% planned), followed by surveillance of diseases (23% in place, 15% planned) and green infrastructure (14% in place, 23% planned, 59% not planned but needed).

Major needs identified, as measured by percentage of respondents reporting that the activity is not planned but needed, include property and resource vulnerability assessments (89%), collaborative regional approaches to manage ecosystems (79%), protection of representative ecosystems of sufficient size (72%), water conservation (71%), farming for biodiversity (69%), and protection of connective corridors between ecosystems (68%).

### *Regional, State, and Federal Actions*

Incentive programs to preserve climate resilient open space and farmland were identified as one of the highest priority needs at the local, state, or federal level, with 75% of respondents selecting this as a 'high need'. Improved coordination and training between the conservation community and regional, state, and federal resource agencies was a close second, identified as a high need by 74% of respondents, followed by water supply planning and conservation programs to account for a changing climate, selected by 73% of respondents.

Other state, regional, or federal actions and programs identified as ‘high need’ include support for habitat restoration projects (72%), development of land conservation targets based on likely climate change scenarios (71%), enhanced best management practices to reduce stormwater runoff (67%), and research on innovative and cost effective strategies for improved water systems management and design (66%).

Other programs or activities that respondents identified there was ‘some’ or ‘great’ need for include enhanced monitoring to establish baselines and monitor changes in species health and crop yield, improved climate modeling capacity for local scale assessments, research on the vulnerability of economically important agricultural species and development of adaptive species and varieties, and implementation of appropriate fire management strategies in forested areas.

### *Critical Needs*

When asked “what does your open space or farmland preservation program most need to prepare and be ready to respond to climate change impacts over the coming decade”, many of the responses focused on the need for more preserved open space and for sustainable funding mechanisms to enable more land preservation. Other needs identified include deer control, ability to model and predict climate change scenarios at the local and regional level, more public awareness, better understanding of the effects of climate change on specific crops and land types, and prohibition of development in flood plains.

### *Challenges*

The biggest challenges identified to achieving preparedness for climate change in New Jersey were lack of political will and lack of public awareness of climate change issues. Other barriers identified include development pressures, local regulations that allow for development in environmentally sensitive areas, the fragmented nature of local zoning rules, and the inherent complexity and long-term timescale of climate issues.

### *Issue Prioritization*

When presented with a list of six challenges to land and farmland preservation and asked to rank them in order of importance, with 1 being most important and 5 being least important, the overall rank order was: 1) Encroaching Land Development, which was clearly identified as the primary challenge, followed by 2) Climate Change Impacts; 3) Alterations to Hydrology; 4) Increases in Contaminants; 5) Introduced or Invasive Species; and 6) Overuse of Trails/Multi-use conflicts.

*Appendix E: Meeting Notes of December 2011 Workshop in Bordentown, NJ*

**Land Acquisition, Conservation and Stewardship  
in the Face of a Changing Climate**

**MEETING NOTES**

December 12, 2011  
Rutgers EcoComplex  
Bordentown, NJ

*Workshop sponsored by the Jacques Cousteau National Estuarine Research Reserve, New Jersey Conservation Foundation and The Nature Conservancy.*

**Goal:** To establish the current state of knowledge around NJ's natural resources in the face of a changing climate.

**Objectives:**

- To discuss ongoing activities and research regarding climate change and its impact on NJ's natural resources.
- To identify the research needs and opportunities of NJ land managers and conservation practitioners.
- To advance the sharing of adaptation strategies and assess what still needs to be better understood.
- To provide a roadmap for future learning opportunities aimed at improving natural resource management in NJ.

**Panel Discussion**

Making Connections between Habitats, Species and a Changing Climate: A Panel Presentation and Discussion Session. Facilitated by: Andy Pitz, Natural Lands Trust

- Assessing the Vulnerability of Focal NJ Habitats to Climate Change - Kris Schantz, Division of Fish and Wildlife
- Planning for Climate Change: Enhancing Habitat for Eastern Tiger Salamanders in New Jersey – Dave Golden, Endangered and Non-Game Species Program
- The Response of Ecological Communities to Climate Change: Impacts and Adaptation Strategies – Kathleen Walz, Office of Natural Land Management

**Q & A Session Notes**

*Question:* In regards to the tiger salamander, how far north is the Department of Fish and Wildlife focusing its efforts?

*Answer:* DFW decided to go as far north as Mays Landing unless they decide "assisted migration" is needed beyond their existing distribution in New Jersey. In addition, ponds in deeply forested areas aren't as successful because there is not enough winter warming.

*Question:*a. What are some opportunities for habitat management and resiliency projects in New Jersey?b. If there is ever a price placed on carbon, will there be opportunities to tie into it?

*Answer:* There are a number of management actions that aren't even necessarily tied into climate change, e.g., better forest management plans, best silviculture practices that can provide habitat necessary for a species. In addition, habitat connectivity is a big issue, therefore, working with land management and moving forward with efforts to map connectivity and modeling for certain species is

necessary. The climate change wildlife habitat vulnerability assessment that will be rolling out in the coming months will be helpful, including in targeting efforts to secure lands.

In addition, more rare species surveys are needed. Due to limited state resources, the federal government and NGOs could play a role in supplementing the state's efforts.

*Question:* How do "stressed" and "un-stressed" systems factor into planning?

*Answer:* Tiger salamanders actually have a certain amount of tolerance to degraded water quality. In addition, overall research and monitoring is currently separated from planning.

*Question:* There hasn't been any mention of water supply issues and the state hasn't developed a water supply plan. Are there any plans to develop such a plan?

*Answer:* Wetlands are at high risk to storm surges, salinity, increased flooding and drought. In addition, the vulnerability assessment being conducted by the state will be factoring in anthropogenic impacts.

*Question:* Which species in the Pinelands are most and least vulnerable?

*Answer:* The saving graces for the Pinelands are the aquifer and the groundwater-fed system, which provides a buffer. The impact on species will be evapotranspiration and pH, both of which are based on temperature.

*Question:* What are some chief barriers to collaborations and successful partnerships both within and outside state government?

*Answer:* The limiting factor, both inside and outside of government, is the amount of available time and resources that others have to spare. Most partners find that others are willing to help, they just don't have the resources or time to do so.

*Question:* Presumably the vulnerability assessment will lead to action. But urban areas may not be targeted, but perhaps they should be in terms of connectivity. What are the chances the connectivity maps coming out of the assessment change policy priorities?

*Answer:* Right now, urban areas are not included in the assessment because it is looking at the current lands and conditions – not future possibilities. However, the state wants to be able to provide actual implementation ideas for NGOs.

**Breakout Session Notes for Combined Sessions of:**

- Targeting upland and coastal land acquisition and management through the climate lenses
- Natural lands management, extreme weather events and climate mitigation

*(1) How much of a priority is climate change when making land management decisions? If climate change is not one of the priorities, what other factors are more pressing for you?*

The priority level of climate change varies from group to group. For coastal national wildlife refuges, it is a high priority level due to a requirement from the Department of Interior that all comprehensive management plans take sea level rise into account (thus requiring updates to the plans) and/or due to tort claims from the municipalities surrounding a refuge. For non-profit organizations that focus on land protection, they are taking sea level rise into account when prioritizing upland land acquisition. Priority level also varies within divisions of NJ Department of Environmental Protection (DEP). For example, the Green Acres program is not structured to take climate change into account. But for other divisions, federal programs are starting to use climate change and sea level rise as a screening mechanism for

various programs so it will inherently have to become a priority for the state. In general, given the funding challenges with the Land and Water Conservation Fund (LWCF), grants sources used to supplement funding will dictate priorities.

*(2) Are you doing anything specifically to plan for climate change?*

Many conservation organizations are implementing specific strategies, including installing living shorelines and bolstering oyster populations to protect against coastal erosion, investing in restoration engineering, using wetland reserve program funds to purchase and restore agricultural lands, and funding projects to attempt to measure carbon sequestration abilities of particular native species and wetlands. In the planning realm, the Partnership for the Delaware Estuary has completed a Climate Ready Estuary report and convened a Climate Change roundtable. As mentioned previously, all coastal national wildlife refuges are required to update their comprehensive plans to incorporate the impacts of climate change and sea level rises. NJ DEP has been developing a coastal resiliency index and “Getting to Resilience” guidelines for coastal communities. In general, participants felt that sea level rise is easier to see and therefore manage.

In regards to extreme weather events, PSEG is also convening a “flooding/extreme weather event” workshop in northern New Jersey. For comparison, the State of Maryland is now looking at 500 year flood events, not 100 year. Also, Vermont’s response to the impacts of Hurricane Irene could serve as a good case study and provide some best practices to employ in New Jersey.

*(3) What additional research/information needs do you have to help you make more informed decisions with climate change, land acquisition, conservation and stewardship?*

A variety of “needs” were proposed during the breakout session, including:

- The state of New Jersey needs to “buy into” a planning horizon, i.e., how many feet of sea level rise should we plan for in the coming decades.
- A compilation of ideas on how to better manage the built environment when it comes to trying to create corridors for migration, as well as ideas for non-traditional means for corridors.
- Need to know how various local governments view climate change in order to know how to best work with them. A common set of messaging/themes for interacting with skeptical partners is also necessary.
- A cumulative economic impact of recent extreme weather events, especially on local governments.
- Technical assistance for land stewardship (e.g., species lists for now and into the future – expected species migration; what invasive species are coming our way.)
- A list of dam vulnerability during extreme weather events and a plan for dealing with the most vulnerable.
- A quantification of the benefits of native plants.
- Research on successful communication strategies.

As a side note, it was stated that many local governments believe that response to extreme weather events or planning for such events is the responsibility of the state, while the state believes it’s the responsibility of the local governments.

*(4) How do we best share research, data, lessons learned, etc. amongst each other? What would that platform look like? Would it be online, in person meetings, small workgroups, etc...?*

A unified vision of the future of New Jersey in the face of climate change is needed, perhaps through a NJ Climate Change Consortium that is established outside of state government. A collaborative organization to undertake coordinated pilot projects to hopefully breaks the “log jam” that exists within the state when planning for climate change and a web-based platform for communication was also recommended. Sustainable Jersey’s Climate Change Task Force was also mentioned as a means for coordination, as well as a planned effort by Rutgers University to facilitate the development of a statewide plan.

**Breakout Session Notes for Combined Sessions of:**

- Habitat and species shifts in the face of a changing climate – Flora
- Habitat and species shifts in the face of a changing climate – Fauna

*(1) How much of a priority is climate change when making land management decisions? If climate change is not one of the priorities, what other factors are more pressing for you?*

Climate change is a priority but not the only priority. It competes with short-term issues (i.e. invasive species) as many agencies plan only about 5 years ahead.

As climate change will have long-term impacts, you need a long-term plan. For example, climate change is just one of the many issues that the Refuges have to consider. Their land acquisition boundaries currently don’t consider climate change impacts, but climate change should be considered in their 15 year management plan.

For NRCS, climate change is important, but they are waiting for more data before proceeding. They did note that conservation easements acquisition for wetlands could be sought in the short-term (i.e. 5 year conservation planning efforts). The reality is that short-term demands trump long-term planning and policy making.

There was discussion that policy tends to target short-term issues. While these are important we need to integrate more long-term goals and actions. Additionally, 5 year plans can begin to start incorporating climate change.

Statewide, all organizations and agencies are working toward the same goals. It was discussed that a comprehensive plan, frequently updated with new information and easily accessible by all stakeholders, would be useful. This plan should be created by a coalition across interests, which will help with buy-in. Suggestions were made that perhaps this plan could be housed by one organization and several present suggested this might be best handled by a non-partisan organization such as a university. It may need occasional small workgroups to discuss new information and how to integrate into a plan.

*(2) Are you doing anything specifically to plan for climate change?*

Some groups are, but need better information as far as climate predications are concerned. For example, the USFWS’ species listing protocols need to be informed by climate change information and vulnerability data. Additionally, designation of critical habitat changes needs to be incorporated into

climate habitat shifts. This type of information is critical now and is also critical in the future as additional areas are affected by climate change.

*(3) What additional research/information needs do you have to help you make more informed decisions with climate change, land acquisition, conservation and stewardship?*

- Consistent set of climate endpoint data
- Specific local data for NJ
- Comprehensive plan for NJ (by multiple interest parties) – online source
- Maryland plan is a good model for NJ

In order to assess risk with climate change, it was suggested that there is a need for comprehensive documents regarding animals and plants, ecological communities and summarizing species and interactions. NJDEP's State Wildlife Action Plan (currently focused on wildlife and their critical habitats, but plans for future versions will include other ecological communities) which for e.g. is on a 10-year cycle while other agencies may have planning documents that are on different schedules for reporting and planning purposes complicates efforts to implement the most current and available data regarding climate change throughout all planning documents in a timely manner. Therefore, a repository or mechanism that would enable various organizations to learn from the most current information would be valuable so that plans and related activities can benefit from the most current scientific information as it evolves. Along these lines, it was suggested that a trends analysis on plant phenology and habitats based on historical data would be useful for moving climate change planning forward.

It was also suggested that a stepped down version of predictive climate models, that are locally significant are needed. These models could be used to identify local critical areas for protection and planning. Planning guidance/documents could also be created based on local maps of climate impacts and vulnerabilities.

The question arose as to the existence of guidelines on how to determine priority factors to consider in planning. It was noted that this type of work has been already done for MD, DE and NYC. It was suggested that a comprehensive NJ strategy (like Maryland has) needs to be completed ASAP and modified with more data is made available.

Apparently the USDA, NRCS "Plants Databox" includes some climate information on species.

*(4) How do we best share research, data, lessons learned, etc. amongst each other? What would that platform look like? Would it be online, in person meetings, small workgroups, etc...?*

This group like all the different ways: online, small work groups, a data repository. They also thought that we could build on existing workgroups such as the Partnership for Plants, Conserve Wildlife Foundation, to help with outreach initially and to build data sets as any effort gears up.

It was also discussed that public education is needed. This approach should consider how to tie climate change impacts into personal issues like water resources, air quality and public health. An education plan should also consider how to deal with public skeptics. This educational effort could also benefit from a report that could be reader friendly and accessible to "all".