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Field Notes:
Extreme Weather and Community Resilience

MULTI-PURPOSE CLIMATE TOOL FOR COMMUNITIES—ONE-STOP PLANNING FOR LAND USE AND 21ST CENTURY WEATHER HAZARDS

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Extreme Weather Looks Like This: 3 State-wide Flood Disasters in 18 Years

The Great Flood of 1993 was called one of the most defining natural disasters in Iowa history. The tally from that catastrophic event: 10,000 people evacuated, 21,000 homes damaged or destroyed, 17 fatalities and over $2 billion in damages. During that summer, it rained somewhere in Iowa every day for 130 consecutive days. Agricultural yields dropped by 62 percent.

That benchmark flood, included within Iowa's most-extreme weather events, has been followed by comparable episodes of extreme and devastating rains and storms in just the past five years. The trend is not good.

2008 brought a statewide mix of tornadoes and floods with 85 of the 99 counties declared disaster areas. 40,000 people were displaced and the total damage ran between $8 and $10 billion.

2010 was a near-repeat of 2008, with severe winds and flooding affecting 63 counties out of 99 counties in the state. On July 24, flood waters overtopped and collapsed the Lake Delhi dam.

Photo credit: iowahomelandsecurity.org.

Iowa State and Counties, and the EPA Partnered on Project to Strengthen Community Resilience to These Extremes of Rainfall, Tornadoes and Winds

In 2008, Iowa created the Rebuild Iowa Office (RIO) to coordinate recovery from the 2008 tornado and flood damage. In the spring of 2010, the Environmental Protection Agency (EPA) partnered with RIO on a pilot project to strengthen community resilience to the increasingly severe weather ravaging the state.

The EPA and Iowa started from a shared understanding that the atmosphere is heating and that the physics of that heating increases the odds of extreme weather. Acting on that premise, the agencies focused on the improvement of local disaster and land-use planning to avoid or minimize future weather damage. The timing was good, because on July 24, 2010, as the project was ramping up, the abstract issues became real when the Lake Delhi dam collapsed under flood waters from torrential rains and uncontrolled runoff.

Both the EPA and the State of Iowa were familiar with then-current studies that correlated inadequate land-use planning with extreme weather damage. Analyses of the major factors in extreme weather damage had been prepared by the National Association of Insurance Commissioners (NAIC: "The Potential Impacts of Climate Change on Insurance Regulation", 2008), the investor coalition CERES (2009), the U.S. Government Accountability Office (2007) and others.

Subsequently, in 2012, the Intergovernmental Panel on Climate Change (IPCC) published a major report focused solely on managing the risks of extreme weather damage. The IPCC expressed high confidence in concluding that building in areas vulnerable to extreme weather is currently the major factor in long-term increases in economic losses due to weather. Other organizations, such as the World Meteorological Organization supported this conclusion. They all highlighted the need to improve land-use decisions by restricting or better-protecting new construction in areas vulnerable to extreme weather damage.

How Many of These Risks Arise

Areas of concern often include scenic, but vulnerable, lands that seem to be magnets for real-estate developers and others who will lobby for and encourage higher-value construction there. Lower-cost marginal land has always been a favorite. Scenic, low-lying coastal frontage, as Hurricane Sandy demonstrated in New York City and along the New Jersey shoreline, is clearly subject to devastating storm-surge and flooding. Marginal floodplains (i.e., greater than 100-year zones) are vulnerable to 250-year or 500-year flooding from rain or snow storms that are increasingly more frequent. With that knowledge, Cedar Falls, Iowa adopted the 500-year floodplain as its locally-regulated floodplain. The action requires that all new construction be at least one foot above the 500-year base flood level, rather than merely the 100-year flood level that is the FEMA threshold for flood insurance.

Similarly, drought damages forests and increases the risks of wildfire and insect infestations that kill trees. The ecology of many forests and chaparrals, particularly in the western U.S., is adapted to natural wildfires from time to time. There is increasing construction of homes, businesses, water supplies and roads in these scenic forests and chaparrals creating areas designated as urban/wildland interface zones. Building human structures that are highly vulnerable to wildfires in such zones requires a conscious decision to ignore the reality of naturally recurrent wildfires. The Black Forest Wildfire on the outskirts of Colorado Springs during the summer of 2013 illustrates the problem and the scale of urban/wildfire interface events. Colorado Governor Hickenlooper's wildfire taskforce recommended in September 2013 that homeowners who choose to live in the urban/wildfire interface zones should pay fees based on wildfire and flood risks.

The Project Focus and Results

With the research available as of 2010 in mind, Iowa and EPA focused on two practical questions:

(1) How can local planning departments strengthen the coordination between existing natural hazard planning and land-use planning to enhance community resilience to extreme weather?
(2) How can they then incorporate the evolving impacts of extreme weather, related to climate heating, into the coordinated approach to natural hazard and land-use planning?

The pilot project yielded two solid results.

The first was passage of Iowa's "Smart Planning Act" that provides combined hazard planning and land-use planning guidance to communities.

The second was the EPA Report (Iowa Climate Change Adaptation and Resilience Report, 2011) on the pilot project. The Report, which is even more relevant today than in 2011, states without equivocation the failure to share information and recommendations, which link natural hazard risks to land use, is a weakness in communities across the nation. It also explores the challenges facing federal and state agencies as they work to provide "planning usable" climate information, cost sharing and examples of how to merge climate impact information into local planning.

The project's working group consisted primarily of Iowa state and county staff, with technical support from EPA and the Federal Emergency Management Agency (FEMA). The Report summary is practical and blunt: "Local governments are at the forefront of adapting to climate change." It includes a thoughtful review of approaches to overcoming the real-world obstacles that communities face in adapting to extreme weather. This analysis adds crucial elements to the literature on community adaptation to extreme weather. Where most previous analyses have focused on the urgency of change and the desired results, without addressing the process of change, this Report, however, addresses the practical, community-level challenges of "how to make change happen" at a useful level of detail.

The Report emphasizes that the difficulties in learning to deal with climate heating are very real. The working group spoke for planners nationwide when they noted: "Best practices and precedents for using climate change data in preparation of hazard mitigation plans have not been established." While the weather over the last half of the 20th Century was relatively stable for most of the country – with only with occasional events of extreme weather – today everyone faces the reality that it is increasingly less-stable now.

Historic, long-term weather records are losing their predictive values, and extreme weather is becoming more common and less-predictable. Learning when and how to transition from older records to expanded reliance on trends from recent weather data (e.g., even from the last 5 years) is a challenge for planners across the country. Communities are, of necessity, experimenting and improvising until national and state-level best practices emerge from the collective efforts of all levels of government.

Land Use is a Primary Determinant of a Community's Capacity to Adapt to Climate Change

In Iowa, avoiding or mitigating flood damage was the immediate driver for the EPA/Iowa pilot project. In other areas of the country there are certain to be additional, or even different, issues. However, nearly everywhere, land-use decisions are made without recognizing that many land areas, formerly safer, are becoming newly-vulnerable to greater weather uncertainties. By default, those decisions are putting costly new investments at un-necessary risk. The risks of potential damage, both by type of event and degree of damage, may vary widely from community to community.

The weather-vulnerable siting of buildings is especially critical in the placement of long-term investments, such as critical public facilities, housing, and essential public services. Even a medium-sized community can't operate for long without water, sewers and waste treatment, energy, fire and police services, hospitals, local businesses, or access roads to essential services and transportation links. The restoration of any of these vital services—after major flooding for example—can take weeks or months. The Colorado flooding of recent weeks, in areas denuded of forest by the summer's wildfires, has left some areas un-inhabitable for months.

Communities know that they should restrict or avoid construction in weather-vulnerable locations. That is not news. But they frequently ignore the risks for a wide variety of reasons. Losing the benefits of prior responsible actions at the local level, we all pay the post-disaster cost in increased taxes. The 2009 MIT Press book, At War With The Weather, page 262, references a 1977 article published by Professors Finn Kydland and Edward Prescott entitled "Rules Rather Than Discretion: The Inconsistency of Optimal Plans". That article was part of the basis for their shared 2004 Nobel Prize in economic science. The Professors are quoted "…unless individuals are initially prohibited from locating in a flood-plain, it will be very difficult politically to force these people to leave their homes." Indeed, the entire FEMA program for "Property Acquisition and Structure Demolition or Relocation for Open Space", by which local communities may relocate residents from homes having multiple-year flood damage claims, is still—to this day—entirely voluntary.

Land use policies that stress the avoidance, or reduction, of exposure to extreme weather are generally far cheaper and more effective than correcting mistakes and paying for property and infrastructure damage after facilities are built. As the recent experiences following Hurricane Sandy (e.g., the scenic boardwalk) show, this applies not only to new development, but also to retrofitting to reduce future risk and to re-building after disaster. In 2007 the Congressional Budget Office calculated that, on average for all natural hazards, $1 spent now to mitigate or avoid the risk of future damage could save the general community an estimated $3 in the future. A similar 2005 study by the Multihazard Mitigation Council of the National Institute of Building Sciences estimated an average future saving of $4 for every $1 spent now to avoid damage.

The First Challenge is Coordinating Hazard Planning and Land-Use Planning. Failure May Put the Entire Community at Increasing Risk

Many communities maintain at least two parallel planning efforts: emergency/hazard planners and land-use planners. Community residents generally are more familiar with local land-use planners at city hall than with the emergency and hazard planners, who frequently

work as staff in the fire department. Too often these two planning efforts do not interact, leading to disconnected, stand-alone plans. The failure to integrate their respective planning weakens the community's resilience to extreme weather.

Over a continuing five-year cycle, the hazard planners update the local "FEMA Multi-hazard Mitigation Plan," which specifically includes natural threats. These plans can strengthen community land-use plans by assessing the risks from natural hazards and proposing actions to reduce community exposure. But hazard planners cannot directly implement their recommendations that relate to land use.

By contrast, land-use planners do have the authority and ability to implement the hazard-plan proposals by upgrading land-use plans, zoning and building standards. Communities will become more resilient by merging the strengths of these two planning groups for long-term land-use decisions. Major investments in public infrastructure, schools, housing and business facilities have life-spans that will extend far into the future of this unpredictable, extreme weather we have begun to experience.

The Second Challenge is Learning How to Use Extreme Weather and Climate Data in Community Planning

Climate Information: Climate researchers are slowly improving their ability to project temperature and general precipitation trends with greater detail at the local scale. But the current "global" starting point for most climate models means that critical details and patterns at the regional or local level are still inherently less-detailed. There is simply not yet enough data at the local level to make reliable and detailed local projections, particularly in forecasting extreme weather damage.

The Report recognizes that this uncertainty makes planning, whether for potential hazards or for land use, especially difficult. Land-use planning for long-term land development is further complicated by the reality that climate change may increase the risks of weather damage over a period not only of weeks or months, but of decades and possibly centuries. At the same time, the currently-available climate information is frequently at a scale, level of detail, and in a format that is not easily used in local planning processes. Federal and state providers of climate and weather information are working to provide the information in formats that are more detailed and descriptive for use by local decision-makers.

New Skills: The Report also outlines a planning skill set that is needed for working effectively with climate disruption and extreme weather data. As climate data become more detailed, local planners, in turn, need to learn how to use that information. The Report recognizes that many small communities may not have professional planners and that other staff may need to be trained to fill those roles. Alternatively, communities may need to hire outside consultants to format climate disruption data so that it is usable in the local planning context. Very likely, communities across the U.S. will need to experiment to learn how to merge new weather data, and actions proposed by hazard planners, into land use plans, zoning and building standards.

The Report also focuses on operational hurdles to knowing what local weather information is most useful in tracking a particular weather risk. For example, during days of heavy rainstorms, what local information will give planners and emergency personnel the most useful guidance on how quickly flood conditions may arise?

One Report example suggests that local planners test their available real-time flood data sources against records of past flooding. As a practical matter, today they have access to multiple real-time information sources such as regional radar reports, rainfall data, stream-flow gauge measurements, and other local information. Their challenge is to determine which of these data sources appear to offer the most reliable and timely guidance about emerging flooding. Addressing the problem may require analysis of past floods and experimentation with computer projections of future rainfall or stream flows. With differing risks and conditions in every community, the best sources to warn of emerging weather risk may vary among communities.

For certain communities, real-time stream flow readings from river tributaries with historical records of flood levels, relative to existing structures, provided the most reliable early-warning of an emerging flood risk. For those communities, rainfall data provided a less-reliable early warning of whether or not a flood would actually occur.
The working group recognized the difficulties that planning staff face as they introduce climate disruption data into their planning. County representatives, in particular, were clear that "Consideration of climate change adaptation is currently viewed as a cumbersome and time-consuming addition to an already difficult set [N.B., land-use and hazard plans] of planning requirements."

This same theme was echoed in a report prepared for the National Oceanic and Atmospheric Administration (NOAA, 2010) based on interviews and focus groups of land use planners from four NOAA regions across the country. The purpose was to assess benefits and barriers to hazard mitigation and adaptation to climate change as perceived by experienced land use planners. While the planners clearly favored accelerating climate-adaptation planning, the limited availability of actionable data was a significant barrier. In addition, the planners also identified as impediments their own lack of technical skills, political constraints, and knowledge about how to use the data that are available.

Learning How to Adapt to Disrupted Climate and Extreme Weather at the Local Level is Primarily a People Issue. At this Level, Emphasis on the Science is Secondary

Cities, towns and counties across the nation are gearing up to make institutional changes within their planning and decision-making processes. Until best practices for dealing with climate disruption and extreme weather evolve, there is no universal roadmap for making the changes. Communities everywhere will be experimenting and innovating.

The tough challenges—of integrating planning and incorporating climate issues--will involve a mixture of local cultural values and beliefs, along with the administrative and legal rules for local government. They will be worked out in a political environment, most frequently around decisions affecting the local economy, land use and security of the community. Every one of these big, difficult and contentious issues is primarily about people, their interests and their values. At the local level the science plays a largely secondary role. Its primary relevance to local decision-making is in demonstrating the need for changes and providing up-to-date information on climate and extreme weather trends.

In the United States, local experience in nearly every community and county attests to the volatility of this mixture of human dynamics. The resulting governmental and cultural changes are rarely easy to achieve. And yet, local communities, counties and states reflect a

strong tradition of successful experience that demonstrates we can make changes in order to take charge of our future.

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How to Get Involved

RRI would like to hear from you. If you have questions, comments, or concerns, please contact us at:

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