



Field Notes:
Extreme Weather and Community Resilience

REACHING AGREEMENT ON MINIMIZING DAMAGE BY EXTREME WEATHER IS EASIER IF WE PLAN FOR UNCERTAINTY

Steven Steinhour June 10, 2013

To Channel or Waffle in Fargo, N.D.

As of April 24th 2013, for the fourth year since 2009, young and old in Fargo, North Dakota, were filling sandbags to hold back melting snow [floodwaters](#) of the Red River. Since 2008, Fargo and nearby Moorhead, Minnesota, combined, have spent an estimated \$195 million annually for damages in those flood years.

To end this crisis, Fargo's mayor rallied public support for replacing this reactive adaptation-by-sandbags with a pre-emptive, engineered adaptation to flood control. But local farmers and residents in surrounding communities are objecting to the engineered solution.

The mayor proposes construction of a 36-mile long Corps of Engineers' channel, 100 to 300 feet wide and up to 29 feet deep, to divert Red River floodwaters. The [channel](#) would leave the river at a point north of the city, loop around to the west of Fargo, and then re-join the river south of the city. Such a channel would take 8 to 10 years to build at an estimated cost of \$1.4 to \$2 billion, mostly from federal money. However, President Obama did not include funding for the channel in his 2014 budget.

The residents of adjacent towns and farmlands, who would be disrupted by the channel, are arguing for a combination of [wetlands and "waffle"](#) within the existing Red River floodplain. In this strategy, the river's original shoreline wetlands would be restored to absorb and slow floodwaters. The "waffle" concept was developed over years of research by university and state hydrologists. It would consist of low berms built around fields adjoining the river to trap flood water in the fields, letting surface water percolate into the groundwater and siphoning off flooding. The cost of this approach is an estimated \$160 million, plus annual payments to farmers, and it could be built incrementally beginning in a year or two.

The Fargo debate illustrates the difficulty of knowing which solution will work best not only for today's residents but also for future generations. Fargo, like the rest of the country, is facing the risks of a future with real, but unpredictable, extreme weather resulting from the increasing influence of climate disruption. Understanding the need to adapt to a future of more frequent Red River flooding

doesn't make the choice of which action — channel or waffle — will be best over the next 50 or 100 years. The uncertainty has fractured local debate.

Acknowledging Uncertainty in Planning for the Future is a Basic Step in the Solution

Fargo is not alone. Society has difficulty with uncertainty. In 2010 the Wisconsin Climate Adaptation Working Group, a state task force, [reported](#) on its study of how uncertainty about future climate risks impairs decision-making on adaptation to climate change. Acknowledging that climate change is already under way, the Working Group tackled the serious climate-adaptation challenges within the varied uncertainties we face. Scientists have uncertainties as to how extreme and how fast the changes may be. Communities have uncertainties about their local risks, adaptation choices, and how quickly they need to act on those choices.

For example, scientists know that the atmosphere has been heating, but not whether the heating over years or decades will be steady or fluctuating. Nor do they know whether natural events such as clouds, volcanic eruptions or absorption of heat by the oceans are temporarily masking an accumulation of heat that may abruptly cause global temperatures to soar.

Similarly, there is very real public uncertainty about the timing of both global climate hazards and the potential damage from local extreme weather that may be aggravated by this atmospheric heating. The Working Group flagged this public uncertainty as a significant reality that slows community decisions on climate and extreme weather adaptation. For that reason public uncertainty about the risks of damage from climate disruption should be explicitly discussed and incorporated into decisions on climate adaptation.

The Working Group report focused on three issues to address in adaptive management of climate disruption:

1. **Uncertainty**—about conditions in the future, about the effectiveness and costs of adaptive management actions, and what people in the future will value as outcomes. [Note: uncertainty dominates the discussion of adaptive management. I explore it further below.]
2. **Benefits**—who pays and when; who benefits and when. [Note: this issue is very real. It is also the meat and potatoes of politics; we actually have extensive experience in resolving it at all levels of government.]
3. **Planning Horizons**—how to sustain 50-100 years, or more, of societal review and decisions on actions to adapt to climate disruption and extreme weather. That term of years far exceeds the planning horizons of nearly all societal institutions. [Note: climate-related damage will demand a progression of solutions. A critical issue will be how to improve our adaptive planning for a wide range of impacts from climate disruption and extreme weather. My comments explore some steps we can take now.]

The Working Group started with the basic difficulty in forecasting the future. “Climate change occurs over a nearly impossibly long time frame...[we can] look back in time 25, 50 or 100 years to see how much change has occurred over the same time scale being modeled in

climate policy.” U.S. communities have little experience with sustaining the adaptive management of extreme weather risks over time periods even remotely on the scale of unrestricted climate change.

The Working Group started with that understanding. Its report focused on helping communities, companies and others plan for climate-adaptive management actions. The report identified six strategies for acknowledging, and incorporating, our uncertainties into future decisions about climate disruption and risks of damage from extreme weather. The strategies are flexible and adaptive for a wide range of potential but indeterminate risks. For purposes of discussion, I have paraphrased the Working Group’s strategies:

1. **No-regrets**—Select actions with a present benefit that is independent of future protection against climate change. Example: building insulation.
2. **Cheap safety margins**—Add an extra margin of safety to presently-planned actions. Example: additional storm water capacity for existing or new drainage systems.
3. **Changeability**—Adopt plans and actions that are easy to change in the future as climate and social conditions evolve. Example: Easy-retrofit construction or protections along rivers and coasts.
4. **Short planning horizons**—Select short-lived policies or actions allowing for repeated adjustments as conditions change. Examples: Enhanced flood plain mapping and flood-compatible zoning and construction.
5. **Reduce complexity and scope**—Favor the narrow and simple (i.e., less costly and easier to change) over the complex (i.e., expensive and difficult to change). Example in the form of a question: How would this apply to the “channel vs. waffle” controversy?
6. **Plan to variances**—Incorporate the relevant “damage avoidance” maximum and minimum variances in planning, not just averages. Example: plan and build assuming water will reach the high flood water mark and, if relevant (e.g., for docks or shipping channels), the low water mark.

Adaptive Management Reduces the Risk from Uncertainty about the Future

Nearly every community reflects its own, unique history of adaptive management for environmental risks. Homeowners routinely build or retrofit in response to increases in natural hazards—stronger, more wind-proof homes; relocation or building on earthen berms and construction of floodable ground floors in flood zones; fire-safe construction with cleared safety zones against wildfires. Usually these are lower-cost adaptive actions within a future planning horizon of several decades. Structural retrofits in California’s earthquake country are examples.

At all levels, from small town councils to the federal government, we have generally been successful over a wide range of community adaptive actions. Police and fire services, medical facilities, clean water and sewage treatment, roads and schools are nearly the definition of a community in the U.S. Additionally, evolving social, economic and environmental demands called for the building of critical regional infrastructures for energy systems, communication and transportation grids, and waterway management.

In all these future-oriented adaptations, there has always been uncertainty about impending conditions. Looking back, we can see where our best-estimate projections may or may not have proved accurate as the years passed. However, Americans have an unusually successful record in adaptive management. Wherever possible, as conditions changed and problems arose over the decades, we adapted, developed fixes, and made improvements.

In this sense, climate change and extreme weather are both old and new challenges. As we go forward, there will be much that is similar to our past experiences with adaptive management. But that sense of familiarity will be shaken by the huge increases we will encounter in the fundamental scale of climatic and extreme weather events. The uncertainties will be greater, the threats are likely to be more severe and erratic, events may last longer, and the geographic scale of weather extremes will expand.

The biggest challenge, though, will be the rigorous necessity to constantly monitor climate change. We will have to evaluate its trends; and make proactive decisions to minimize risks of damage to our communities from extreme weather. During the 20th Century, we became accustomed to transient weather events that lasted from days to months, or years in the case of drought. But increasing climate challenges will strain our capacity to sustain our focus on extreme weather planning—over decades and perhaps even a century or more.

Will “Mainstreaming” the Responsibility for Adapting to Climate and Extreme Weather be Adequate over Decades or a Century?

The challenges of climate change are already evident. They may extend indefinitely into the future for the U.S. and every community. Even though the Working Group illustrated the future with a 50- to 100-year planning horizon, there is no currently known horizon for climate change. It could be 50-100 years; it could be 300 years or more. What this means is that our community, economic and governmental institutions, which plan adaptive management strategies, may have to sustain their focus on climate change over an open-ended future.

Since American communities lack experience with long-term deteriorating climate, we will be forced to experiment. To this end, the Working Group sensibly proposed adding the tracking of climate change as a new responsibility for institutions already engaged in planning for the future. Without limiting it to government, the proposal would apply to all agencies and groups planning for land use, water, infrastructure, the environment and the economy, at every level of scale.

This placement of a new issue into the mission statement of existing planners is known as “mainstreaming.” It is commonly done when the issue is not immediately solvable and requires frequent revisiting. Mainstreaming ensures that planning attention to the issue will be consistent, repetitive and demanding over time.

Communities will truly be the front line in facing the challenges of evaluating, planning and implementing, as needed, local adaptive management of extreme weather risks. If it turns out that climate impacts evolve gradually, rather than abruptly, mainstreaming may work for many decades. Adaptive success would give us valuable time in which to mitigate climate change directly and begin the long struggle to restore a more benign climate. Analyzing climate issues repeatedly in different planning contexts will enable planners to understand

the many ways that climate affects their decisions. That shared problem-solving experience will make it easier for different stakeholders to resolve large-scale climate issues that extend beyond the planning boundaries of separate agencies.

First Steps to Making Climate-Adaptive Planning More Effective Now

Many communities and counties across the U.S. already have at least two planning systems: Land Use and Emergency & Disaster. The mainstreaming of climate change raises the stakes for ensuring that these two groups of planners share information and planning proposals.

Emergency & Disaster planners, at the county or community level, already track and assess natural and man-made hazards, and respond to disasters. They may be staffed in an office of emergency services, a fire department or other agency. They are responsible for assessing the risks of damage or loss of life in the community. This group frequently is responsible for updating the community's FEMA Multi-Hazard Mitigation Plan, or for contributing to a FEMA multi-jurisdictional plan, every five years. They analyze risks and plan for adaptation or mitigation actions to reduce damage. But they lack the ability to implement their plans directly through changes to zoning, land-use regulations or improved building standards. They need community Land Use planners to implement their proposals.

Land Use planners, who comprise the planning department in many communities, work with the community on day-to-day operating issues: land-use plans, zoning regulations, building standards, permits and public infrastructure. They are responsible for implementing the plans, laws and regulations by which the community minimizes the risks to buildings and infrastructure from natural hazards. Land use planners need current information on trends among different natural hazards, where critical hazards are emerging, and what risk-reduction actions or best practices are proposed. Communities may have internal administrative barriers to open discussion of that information between the two sets of planners.

Communities that consider mainstreaming climate change might review whether they have this dual planning structure in effect. Where it exists, the community will benefit by requiring that both planning groups share information on extreme weather risks, potential adaptations, and proposed implementation. At little cost, this can ensure that the community's land-use and building standards incorporate the latest hazard-risk assessments. The community will be more resilient to extreme weather risks, more climate-aware and more robust.

Adaptive Actions are not Solutions—They are Waypoints in a Future of Adaptive Management

Whether Fargo selects “channel” or “waffle,” the decision will be tested by climate change over future decades: no surprise there. The “channel” may work, but it bets the future of Fargo and Moorhead on a single, fairly inflexible solution and a particular set of assumptions about the future. It will be costly, and it will be difficult to change if it doesn't work under future conditions.

Equally, the “waffle” system may work. If it were to fail, changing to a more effective response to unexpected future conditions would be easier. It is far less costly and, since it involves minimal changes to the existing river floodplain, it could be changed as needed or abandoned with relatively little loss.

However “channel” and “waffle” each raise real-world questions that should be added to the Working Group’s excellent strategies for dealing with climatic uncertainties. In addition to weighing the ease of adaptation to future conditions, there is also a checklist of questions about another aspect of uncertainty. That is the uncertainty about the likelihood, circumstances and cost of failure of an adaptive choice.

If either Red River system were to fail, what would be the consequences of that failure—the very first time it happens? Would Fargo, Moorhead, or some other community, be massively damaged by the first failure? Or might it more likely be moderate damage? Would there be recurrent failures with increasing damage? Would there be time and resources to build an alternative solution, perhaps at a time and under conditions giving a more confident understanding of future extreme weather trends?

Other checkpoints might be the extent to which there is coordination between land use and disaster planners. Where surrounding communities are affected, it seems reasonable to ask whether there has been a regional look at the consequences of failure under either system. Shifting the problems, costs, or risks to other communities, rather than working out a regionally-equitable approach seems, at the least, questionable. The fact that the current “channel or waffle” dispute even exists illustrates the real-time challenges of climate and extreme weather adaptation that communities will have to resolve.

Fargo is pursuing an adaptation based on its current forecast of the future, knowing that conditions may well change. The City will have to monitor continually the effectiveness and safety of its decision under evolving flood conditions. The Fargo experience—particularly the necessity for constant focus on extreme weather trends—is being repeated in varying ways across the nation.

The imperative to constantly track extreme weather trends illustrates why our response to unrestricted climate change over many decades—and extreme weather hazards, year by year—will be a marathon. There will be no relief from long, perhaps dull, years of careful monitoring and adaptation—punctuated by occasional desperate sprints.

Ultimately, perhaps, the greatest uncertainty every community faces is that we do not know where the finish line is; or even whether one exists.

Editorial thanks to Nancy Graalman

How to Get Involved

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Resource Renewal Institute
187 East Blithedale Avenue
Mill Valley, CA 94941
415.928.3774
info@RRI.org

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