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LONG TERM SOCIAL AND ECONOMIC IMPACTS OF EXTREME FLOODS

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Abstract. Extreme floods have serious social and economic impacts. Social science research following disasters is quite limited. Few researchers look back following major disasters to identify lessons to be learned from the recovery that might have implications for pre-disaster mitigation planning. Most longitudinal studies are 25 years old. This paper summarizes the existing research efforts on these impacts, reviews the actual impacts from nine extreme events, and provides recommendations for future research. Clearly there is a need for more coordinated post-audits following extreme floods to provide possible guidelines for communities to implement to limit long term social and economic impacts.

1. MEASURING SOCIAL IMPACTS OF EXTREME FLOODS

Major floods occur every year. However, there is no comprehensive or organized compendium of research that evaluates the long-term impacts from these events. For example, difficult questions must be answered before the significant research gap can be filled:

(1) what time frame constitutes long-term? A relocation plan may move an entire town to higher ground after a major flood. The community might support the new location. But ten years later the relocated town may not have the comfortable feeling of home;
(2) what would have happened in the community if the flood had not occurred? In other words how can the social and economic effects of a flood be isolated from other local, regional, and national factors? and,
(3) while some people lose in major floods at the different geographic scales there are winners and losers. How can the negative effects of a flood on a family or neighborhood be evaluated when they may be overshadowed by prosperity at the community scale?

When studies have been done, there is no consensus about the long-term social impacts from disasters. A bibliography completed in 1996 identifies few studies on socioeconomic aspects of flooding in the U.S. (Wiener 1996). Descriptive case studies indicate that after a flood, trends already in place are reinforced. The trends, whether positive or negative may be accelerated by the disaster (Haas, Kates and Bowden 1977). A flood in a community that was experiencing rapid economic development would accelerate the trend of economic development. A downward trend would also be reinforced.

In earlier decades, formal regression and time series studies after disasters (Friesema et al, 1979) indicated the difficulties of trying to generalize. Numerous disparate studies discuss the relative resilience of communities compared to individuals, (Wright, Rossi, Wright and Weber-Burdin, l979). Economic gains by communities based on the extensive outside relief assistance have also been noted (Dacy and Kunruether, 1969).

More recent research attempts to quantify the lasting post-traumatic stress syndrome on individuals in disaster-impacted communities (Tobin and Ollenburger, 1996, Erickson, 1998). For example, a study of suicide rates before and after disasters indicated that suicide rates rose 13.8 percent in the four years after floods (Krug, et. al, 1998).

Montz and Tobin (1998) Tobin and Montz (1994a) are evaluating how extreme floods affect real estate prices. So far their work in Linda and Olivehurst, California, indicates that residents with the most severe flooding do see long lasting impacts on the house price. Homes with limited damage seem to be unaffected. In fact the prices go up for some homes in damaged areas because following the flood, the homeowners replace all the appliances, paint and carpets. The houses increase in value to reflect the sprucing up. The results show clear spatial variation across the cities.

After a disaster a community goes through four phases that overlap: the emergency period, the restoration period, the replacement reconstruction period, and the commemorative betterment period (Haas, Kates and Bowden, 1977). Each phase takes about ten times longer than the previous one. The rate of recovery is directly related to the extent of damage, the available recovery resources, the prevailing pre-disaster trends, and community leadership and planning (Haas, Kates and Bowden, 1977). These phases can be used as general planning guidelines for community officials.

Losses are considered to be direct or indirect. Direct losses are difficult to quantify and it is even more difficult to evaluate indirect losses. Direct measures are the number of business and homes destroyed, for example. Indirect costs include migration from the area as a result of the flood, tax losses as consumers shop outside the damaged area and what are the costs of outbreaks of waterborne diseases.

As in other crises, extreme floods test people and relationships. Recovery tests social as well as physical strengths (Hanchett, Akhter, and Akhter, 1998:226-7). Official stories show that women relied on male relatives and were somewhat passive. A closer look reveals something quite different in Bangladesh (Hanchett, Akhter, and Akhter, 1998: 227).

Right after an extreme event, the community has a sense of unity. The common problems of recovery and reconstruction take precedence. The reemergence of community conflict is a sign that the recovery is complete (Quarantelli and Dynes, 199). The areas of conflict may be different than before the disaster but the reemergence of complaints often signifies the return to normalcy. The editor of the Grand Forks, North Dakota newspaper noted this about one year after the l997 floods. He pointed out that people started complaining about sports score coverage and their preoccupation with flood matters had diminished.

The impacts vary significantly on the scale of the analysis. The size of a community influences the complex recovery process. Larger communities have a larger resource base compared to smaller ones but demands on their resources are many. The distribution of impacts is uneven (Tobin and Montz, 1997:171).

A flood may be devastating for a family or a small town but the entire metropolitan area might be resilient enough not be severely affected by the same event. What may be a disaster for a family or a small part of a city may not show up as having an impact on the larger community

using traditional measurements. Economic measurements are difficult but they are much easier to make than estimating the disaster's impacts on the emotional and social structures. Natural disasters are a formidable challenge for impact analysis (West and Lenze, 1994:127).

In developing countries floods have distinctive long-term effects. They can be divided into three categories: (1) consequences for human health including death, physical injury, disease transmission, malnutrition and loss of morale; (2) consequences for agriculture; and (3) impacts on housing and infrastructure (Alexander, 1993:524). The duration and significance of the impacts depend on the levels of resources available to easy recovery and on the scope of the devastation (Alexander 1993:525).

2. CASE STUDIES

This paper briefly revisits the long-term effects of nine extreme flood events. There is wide variation in the impacts on the communities.

2.1 1889 and 1977 JOHNSTOWN PENNSYLVANIA U.S.

Johnstown, Pennsylvania has had a series of disastrous flash floods. The city holds an annual ceremony to commemorate the worst disaster. On May 31, 1889, 2209 people died when a dam broke. Nearly 400 children were killed and 99 entire families were wiped out. More than 750 bodies were buried in one grave and were never identified.

In the 1889 flood the South Fork Dam that broke was originally built to hold back a reservoir on the Pennsylvania Mainline Canal system. A swank sporting club for rich Pittsburgh industrialists enjoyed the reservoir behind the dam. In late May of 1889, following heavy rains, the water behind the club's earthen dam rose two feet overnight. Runoff from nearby hills, denuded by logging, exacerbated the rise (Reed 1998). The city of Johnstown, 14 miles away, was smothered by a wave. More than 1,500 homes and 280 businesses were destroyed. While the club was found grossly negligent, no damages were ever paid to Johnstown residents.

The Flood Commemoration, cooperatively sponsored by the Johnstown Area Historical Association and the National Park Service, descended from the survivors' banquets held in the 1970s, although the flood has been formally commemorated in one way or another since 1891. Visitors to the Johnstown area can see the remains of the dam and other sites connected with the flood and visit the Johnstown Flood Museum. An Academy Award winning documentary was also completed on the impacts and long term recovery of Johnstown.

On July 19, 1977 more than eight inches of rain fell in three hours over the Conemaugh River and 76 people were killed in Johnstown. Once again dams were involved in the flooding. A visit to Johnstown indicates that the community has not yet healed from the more recent event. The extensive flood museum exhibits speak primarily of the l889 flood.

2.2 1972 BUFFALO CREEK, WEST VIRGINIA, U.S.

Buffalo Creek, West Virginia is known to have suffered the worst (and best-documented) long-term impacts. On February 6, 1972, 132 million gallons of debris-filled muddy water burst through a makeshift mining company dam and roared through Buffalo Creek. One-hundred-and-twenty-five people died in the flood. Four thousand of the five thousand residents lost their

homes. Following the flood, survivors from a previously tightly knit community were crowded into trailer homes with no concern for former neighborhoods. The result was a collective trauma that lasted longer than the individual traumas caused by the original disaster.

Of the 615 survivors examined by psychiatrists, 1½ years after the event, 93 per cent or 570 of them were suffering from emotional disturbance. Nearly everyone had a close encounter with death from the event. Sociologist Kai Erickson has made a career commitment to understanding the lasting impacts of this flood disaster. He evaluates the particular characteristics of the Appalachian experience and the nature of coal mining as the context for understanding the effects of the Buffalo Creek flood. Was the $13.5 million judgement against the coal company in 1974 a victory? Or, was it a marker of the end of the recovery? But for many residents, it meant having to make decisions that had been pending. The settlement day was like a move to the restoration phase (Erickson 1998:249). Erickson poignantly points out how the texture of the community was changed forever by the flood.

Reconstruction was not in keeping with previous patterns of housing or neighborhoods. Also ties to family and neighbors that had been so important before the disaster broke down. Erickson concludes that the people of Buffalo Creek suffered two disasters: (1) the gradual deterioration of mountain culture, and (2) the flood of February 16, 1972. He is not very optimistic that the people who were already at the margins of American experiences could reconstruct the sense of community they had before the flood.

2.3 1972 RAPID CITY, SOUTH DAKOTA, U.S.

In Rapid City, South Dakota a catastrophic flash flood killed 237 people on June 9, l972. The city already had extensive urban renewal plans. The city had already earmarked numerous structures for acquisition or demolition and the flood dramatically accelerated the plans. The flood cleared the floodway of obstacles.

Following the flood, the floodplain redevelopment included a greenway along the creek and public open space to accommodate floodwaters. Rapid City received extensive praise for its innovative floodplain management. The city's greenway is considered an excellent example of wise multi-objective use in a floodplain. However, there now is pressure to build additional buildings along the greenway that will reduce the efficacy of the flood control efforts. Perhaps the memory of the flood is no more than 25 years, or just beyond one generation's recollection?

2.4 BANGLADESH FLOODS 1987 AND 1988

There are strong connections between vulnerability to flooding and poverty. Vulnerability is a human-created environment. Economic and social systems allocate societies resources to the detriment of some groups and the benefit of others. This level of vulnerability affects people's capacity to withstand floods, and also exposes them to flood risks unequally (Blaikie et al, 1994:124). Flooding may be associated with famine and famine may be the more significant cause of death. Floods can increase long term vulnerability by long term disruption of livelihoods and the loss of land and other assets. Bangladesh experienced immense flow-onset flooding for two years in 1987 and l988. These floods followed devastation in l984 and l974, which increased vulnerability.

Flood waters brought increased risk of cholera and dysentery and the rapid growth in the incidence of malaria and yellow fever. Respiratory illnesses also follow slow-onset floods

affecting especially very young children, babies and the elderly. The sick and injured usually cannot work which also affects the ability of families to recover.

The length of time the water remains on the land also affects the agricultural prospects. In Bangladesh there is often a good harvest associated with floods (Blaikie, et al, 1994:130). In l988 the serious floods brought a record harvest. However, a household whose water buffalo has died in a flood, or which for other reasons cannot take advantage of these soil moisture conditions, will not be able to plant in a timely way and catch up. The World Bank and the government Bangladesh have plans for an expensive technological fix called the Flood Action Plan. The plan consists of high embankments along much of the length of the main rivers. Alternative smaller scale projects have been proposed by non-governmental organizations. The plans are quite controversial and only the record will show the winners and losers once the structures are in place (Blaikie, et al, 1994:139-41).

A number of studies have evaluated the impacts of the official Flood Action Plan. Study findings demonstrate that men and women participate in programs related to the Flood Action Plan. There are many women heads of households and they are closely involved with agricultural production. Women manage the households that are seriously affected by flooding. Numerous conferences and workshops were held where many officials and donor country representatives continued to argue that development programs, social problems and gender inequality should be separate from flood mitigation programs (Hanchett, Akhter, and Akhter, 1998:228).

The studies showed that socioeconomic class was a key factor in determining people's ability to cope with severe floods. Economics caused more problems than floodwater. This finding must be considered in national and international policy (Hanchett, Akhter and Akhter, 1998:229). Other studies have also shown that the interests of elites prevail in new development schemes such as the Flood Action Plans.

As a result of the workshops and reports more participation by women in water planning has been initiated but getting the dialogue going has not been easy. An electronic conference on gender and water has been established at http://www.gwp.side.se and a site on gender and disasters can be found at http://www.fiu.edu/orgs/IHC/gender/.

2.5 1976 BIG THOMPSON FLOOD, COLORADO U.S.

On July 31, 1976, 140 people were killed when up to 14 inches of rain fell on the headwaters of the Big Thompson Canyon. The steep narrow canyon was filled with tourists and the flood occurred on a summer Saturday night. Damages exceeded $30 million.

Research soon after the flood identified which residents were having the most difficulty coping. There have been no follow-ups to this study to evaluate long-term impacts. Twenty years after the flood, Anderson and Wamsley (1996) published a book with compiled stories of a few long-term residents from the night of the flood indicating how the flood changed so many lives. Any profits from the sale of the books are designated to community memorial projects. The book's publication had a cathartic healing impact. A quote from the book follows:

"*These wonderful people whom we had known for so long started opening up their hearts to us, sharing their stories and the grief that had been trapped inside for 20 years. We had no idea the effect it would have on them. It was a time for healing…. Our hearts go out to those of you who still have bitterness*" (Anderson and Wamsley, 1996:19).

There are numerous commemorative efforts in the canyon including memorials to those who died, and the remnants of the power plant that was destroyed by the flood that is now a small park for picnics. However, now a generation later newcomers are sometimes not aware that such a catastrophic flash flood occurred in the canyon. There are new development pressures and land that has been left open to reduce flood potential now may be developed.

The Big Thompson flood has had extensive impacts on the community of geologists, hydrologists, meteorologists, engineers and social scientists who work in Colorado. There have been two symposia to commemorate lessons from the Big Thompson Floods (Gruntfest, 1987; Gruntfest, 1997). The Proceedings volumes stress how this one extreme flood has influenced thinking about flash floods in Colorado and in broader regional, national and international contexts. One of the primary conclusions in 1986 and in l996 was that flash floods require different sets of science and policy than slow-rise floods. There already has been one generation of professionals determined to learn from this one extremely deadly flood.

In 1998 there are fewer structures in the Big Thompson Canyon than there were in 1976. The Canyon traffic moves faster to and from the growing city of Estes Park, just west of the Canyon. Fewer people live or picnic along the banks because the flood exposed the riverbank and the trees have not grown back yet. Many of the hotels and cabins where people used to stay were washed away and because they were in the designated floodway were not permitted to rebuilt.

While Anderson and Wamsley's (1996) edited collection tells the stories of the Big Thompson community members, it also clearly urges that people heed warnings in the future and recognize that their survival may depend on getting to high ground in a short period of time. The book recognizes that there may be "false alarms" but that it is "better to be safe than sorry". This outlook recognizes that the flash flood potential is serious and just because the Big Thompson Canyon has had a catastrophic flood, there will be future floods too. The beauty of visiting and living in the Canyon is accompanied by the need to be vigilant. This valuable lesson has been learned since this disaster.

2.6 1993 MIDWESTERN U.S. FLOODS

Damages from the l993 flood in the Midwest exceeded $18 billion. The flood inundated 10,300 square miles in nine states and 52 people lost their lives. There is uncertainty about whether these events qualified as 50 year, 100 year or 500 year events. In l993 only 52 lives were lost as a reflection of improved flood forecasting and warning systems. The Great Flood occurred between April and August and actually consisted of a series of floods. Within the immense storm systems were at least 175 cores of heavy rain, each producing more than 6 inches of rain in short periods and numerous flash floods (Changnon, 1996:6)

Changnon's edited collection evaluates the direct, secondary, and tertiary impacts of the flood. The study shows the difficulties of estimating losses. For the state of Iowa the official loss estimates range from $3.4 billion to $5.7 billion (Changnon, 1996:8). Detailed discussion on agricultural and social impacts can be found in pages 282-297. Basically the reports show enormous regional impacts from the floods in terms of winners and losers. At the national level, the floods did not significantly affect the national economy.

From a broad financial perspective, government funds, insurance payments, and private capital have been spent to rebuild damaged property and the state's infrastructure, and these recovery expenditures represent a benefit to the state's economy. Are they losses or gains?

Should these inputs be subtracted from the losses? (Changnon, 1996:8-9). These questions illustrate the difficulties of accurately estimating total flood losses.

The conventional wisdom is that people always want to return to the floodplain after the flood. Flood victims are shown on television promising to rebuild. However, in an increasing number of cases communities are relocating outside the flooded areas.

Following the l993 Mississippi River floods the town of Valmyer, Illinois took the recovery funds and moved the entire town to higher ground. The town of 900 people moved to a 500 acre cornfield and woodland on a bluff above the ruins of the old town. Two years after the flood most of the residents were living in their new homes. The town also experienced serious flooding in l910, 1943, 1944, and 1947. Financing and construction involved 22 government agencies and costs were approximately $28 million (Watson, 1996). Their flood problems were replaced by a different set of issues related to community structure (Tobin and Montz, 1994b).

What are the implications of long-term relocation efforts? Major community relocation projects are underway and other entire cities are being moved. Other communities with major relocation projects include Grafton, Illinois, and Rhineland and Pattonsburg, Missouri. Communities that opt for moving take this measure only after a series of devastating floods. Soldier's Grove, Wisconsin was frequently flooded and finally the community leaders and residents arranged to use the recovery funds to move the entire floodplain part of the city to high ground. A study ten years after the move revealed that many people still did not think the new town felt like home. Future research should evaluate the relative merits of taking the drastic measure of moving a community. Time will tell how the Valymyer residents feel about their relocation.

In his survey in Des Moines, Iowa, Tobin and Ollenburger found that a large percentage (71%) of respondents displayed symptoms of post-traumatic stress. Stress systems appeared equally across gender, income and age stratification. Results showed the previous health conditions, employment status and propensity to interpret the flood negatively were significant predictors for high levels of post-disaster stress (Tobin and Ollenburger, 1996). A follow-up on this study is underway.

Tobin and Ollenburger found the stress was worse for women than for men. This finding differs from the work of Fordham and Ketteridge in their l996 work in Scotland. Leadership by women is not always recognized within the official record. Often their efforts occur outside the public sphere. Women operate in the private sphere, at home, with children.

In 1994 city officials in Des Moines wanted to have a commemorative celebration for the flood recovery. However, there was no public interest in the effort and the event was cancelled.

The 1993 floods had winners and losers among residents, businesses, agriculture, and industry (Changnon, 1996:283). Initial flood loss estimates were between $12 and 15.7 billion. Although regional impacts in the nine-state area were extreme, flood losses in the national economy were not noticeable (Changnon 1996; Amato and Timmerman, 1995.) The Changnon study highlights the losses from the 1993 floods but also indicates there were winners as well as losers. For example, many nonflooded Midwestern farmers benefited by higher grain prices brought about by the floods (Changnon, 1996:284).

Even though there were extensive warnings before the floods, only 10 per cent of insurable properties had flood insurance coverage (Changnon, 1996:257). The availability of disaster assistance is perceived to be a disincentive for buying flood insurance. If the government is going to bailout flood victims, why should anyone buy flood insurance? At the

turn of the century national attention is finally being directed at reducing flood bailout payments to communities and properties that are chronically flooded (Conrad, 1997).

The flood did not change the nations gross domestic product in 1993 but it was expected to increase the gross domestic product by .01 percent in 1994 due to expenditures for flood repairs. One of the greatest flood problems was the damage to surface river transportation systems. Barge traffic was halted. Changnon (1996:285) wrote:

> "*It took three to nine months after the flood for the stocks of most of the barge-dependent shippers and receivers to return to normal*"

Many tourists changed plans and did not visit the region because of the extensive media coverage of the floods. The losses to businesses engaged in tourism are estimated to be between 15 and 34 percent of the annual $1.2 billion spent each year (Changnon, 1996:289). These figures are complex and flood loss data are not precise but they do provide a picture of the flood impacts.

Businesses not affected by the flood did handle increased business. Railroads hauled increased tonnage that could not move on flood-stalled barges, for example. In 1994 most farmers had their best soybean and corn crops in the midwest. Farmers removed sand over the winter, leveled the land and planted crops on all but 27,000 sand-buried acres (Changnon, 1998: 255). Long-term impacts from this extreme event should continue to be followed.

2.7 YUBA CITY, LINDA, AND OLIVEHURST, CALIFORNIA FLOODS

Throughout the 1990s levee breaks have caused severe floods in communities that are <u>not</u> formally in the designated floodplains. The levee construction removed these communities from floodplain maps and cleared the way for residential development.

In 1986 and 1997 serious floods did occur. Montz and Tobin (1997a) are studying how the floods have affected real estate prices. They found that in houses that had been completely inundated at a depth of 10 feet, housing prices have not recovered to preflood levels. Some houses with some flooding did appreciate in price more than other houses in a particular neighborhood because all the appliances, floors, furnaces, and other features were new following the flood. Montz and Tobin do recognize that the flooding is only one factor in determining the house prices.

Other factors including the healthiness of the local and regional economies, changes in the local growth patterns, mortgage interest rates and other factors are also important factors. And, their effects can not effectively be separated from the effects of the floods. They also wonder how long the floods will continue to have an effect on the housing prices.

2.8 1997 GRAND FORKS, NORTH DAKOTA, U.S.

When the spring flood receded, the city of 50,000 had sustained more than $1 billion in damage. Of its 11,000 houses, 8,000 were damaged, and another 750 lost outright. Hundreds of businesses suffered serious losses. Most churches, schools, and public institutions were closed. Grand Forks endured the largest per capita disaster in U.S. history (Findley, 1998). With 20 percent of its downtown commercial buildings burned, and the rest with neck-high water damage

on the ground floor, the citizens of Grand Forks had to decide whether to abandon the traumatized downtown or rebuild it. They decided to rebuild (Findley, 1998).

More than 80 per cent of the city was inundated and nearly every citizen was evacuated. City council member Glassheim writes that in a time of unexpected disaster, people yearn for simple, decisive answers that will give them hope and encourage them to rise above the loss. He notes however, that people prefer unpleasant facts to uncertain or overly complex responses. Yet, he acknowledges how difficult it is to find simple answers (Glassheim, 1997).

The state art museum is archiving all the impacts of the flood. The newspaper, the **Grand Forks Herald** won a Pulitzer Prize for its coverage of the flooding and its determination to keep publishing as the soul of the community even after its building was inaccessible. The newspaper pumped up its print run to 60,000 after the flood and printed in Minnesota. The paper was distributed for free. The editor, Mike Jacobs said our people have been displaced and there is nothing they can touch, hold or have but this newspaper. We are the touchstone for the community, and that is a great responsibility and opportunity. On April l9 a fire destroyed the Herald's archives including microfilm of the first edition of the paper from l879. The newspaper's commitment to a $3 million new building downtown is helping to bolster downtown renewal.

One of the most interesting aspects of this flood was the angel who emerged to help with a contribution of between $10 and $50 million in $2000 sums. Glassheim (1997) writes the selfless gesture turned ugly. The well-intended declaration of no red tape may have done more harm than good as people struggled over those deserving of the assistance. Questions about whether people who were homeless before the flood should have the money or only people forced to evacuate after the flooding were troublesome.

Alice Fothergill (1998) is completing her dissertation research on the particular long-term recovery issues for women in Grand Forks. Her findings include the following:

> (1) Day care was almost non-existent immediately after the flood and families struggled with taking care of children, returning to paid jobs and repairing their homes;
>
> (2) Housing remained a problem. Many people stayed in Federal Emergency Management trailers or other temporary housing for months. The trailers were very cold and had limited space. A year after the flood some people do not feel settled;
>
> (3) Families and individuals experienced a loss of community. People still mourn their old neighborhood, home, and other elements of their preflood life; and,
>
> (4) There may be increases in domestic violence six months to one year after the flood. There has been a large increase in service demand by the Violence Intervention Center for counseling, protection orders and shelter. The old shelter was destroyed in the flood. The new one will not be completed until 1999, two years after the flood.

One woman's experience is illustrative. She is a 42-year old well-educated woman with two sons. She believes her husband's violence was a result of the flood. She says:

> *"the crystallizing incident took place on Mother's Day, May 9th. Over the last year, almost every day, it's been sort of a slow onset of sort of a paranoia about, first of all,*

other men, of which there are none. And then he started getting more aggressive about it, going through my work papers. It got so bad I couldn't go anywhere. He's never had a very good temper, but it's gotten really bad. Pretty much isolated me from my family. The first year after we were married there was an incident, but nothing until now. He likes things very ordered and when things are out of order he gets mad. So the flood was a nightmare for him".

The relative amount of loss experienced is related to whether individuals and families want to move on or dwell on their losses. People who lost everything experience a loss of their sense of self. They feel that other Grand Forks residents who experienced more limited loss do not understand how them.

Remarkably, no lives were lost in the North Dakota floods. One reason that the community might recover more quickly than other communities is that President Clinton offered 100% coverage of all emergency measures and debris removal. There are more than 50 federal programs involved in the recovery from the 1997 floods. The numerous programs range from handling hazardous materials washed overland in the flood event, to temporary housing programs, to watershed management programs, to historic preservation programs.

In re-establishing the economic viability of the community a $300 million higher dike is being constructed by the U.S. Army Corps of Engineers. This massive structure will give the community a greater sense of protection from the next flood. It is too soon, only one year after the event, to evaluate Grand Forks recovery as a success.

3. RESEARCH RECOMMENDATIONS

- COMMUNITY LEVEL. What we have seen is that there have been long-term impacts of flood disasters. The most serious impacts have been seen in Rapid City, South Dakota, Darwin, Australia, and Buffalo Creek, West Virginia. In South Dakota, the designation of the floodplain as open space had urban renewal benefits as well as reducing the overall flood risk. In Darwin, families torn apart by the evacuation were unable to reconstruct following the flood. In Buffalo Creek, the catastrophic flood accelerated serious deterioration in the resident's sense of place and undermined the community's sense of well being. It is too early to tell the long term impacts from the Grand Forks, North Dakota floods and even the massive l993 midwestern U.S. flooding. The residents of the Big Thompson canyon have moved into the commemorative phase with the publication of their own book chronicling individual stories published 20 years after their catastrophic flash flood (Anderson 1996). Alice Fothergill's dissertation on the recovery patterns for women in the Grand Forks flood offers excellent promise for new research directions. A close look at how women's leadership patterns, organizing skills, and informal networks are used or not used may offer new strategies for official recovery programs.

  More research comparing flood disaster impacts is long overdue. There is a flurry of interest during an event and then in the short-term recovery period. Few researchers in the last 20 years have conducted any comprehensive assessment of long-term impacts or any comparative studies. It is surprising that there are so few theses like Judith Miller's work on the Big Thompson flood or Kai Erickson's studies of the Buffalo Creek flood to illuminate long-term social impacts. The difficulties in isolating the flood impacts from other political,

social and economic factors and isolating the flood impacts within a complex regional economy are daunting. Disasters always bring winners and losers and if researchers try to take an aerial view it is often hard to sort them out in any meaningful way. The studies of the impacts of floods on property values should be continued and strengthened. Clearly flood disasters can have catastrophic impacts on families, businesses and small communities. However, we need to have a comprehensive set of analytical tools available to monitor and track how various major extreme floods change the long-term economic and social conditions in communities. It may be that each event must be understood in its local context (Erickson, 1998:246) with a focus on the particularities of the locale, the history of persons involved, and the contours of the event. Or, it may be that generalizations can be drawn from parallel flood disaster experiences that can be applied to mitigate long-term effects from future extreme floods. More work by social scientists needs to answer these questions. Before 1990 in the U.S., communities were more reliant on their own resources for flood recovery. Since 1990, federal relief has become more available. To what degree do state and federal regulations enhance or detract from local community ability to recover? Also, does the promise of relief reduce the incentive to worry about long term vulnerability to future floods?

- INDIVIDUAL LEVEL. There is increasing interest on the part of psychologists and social workers in disaster impacts. The attention to post- traumatic stress disorder is extremely valuable. It offers insights into how a disaster experience can affect every realm of an individual's life. Treatment options are being explored which may identify how to mitigate the long-term impacts of disasters on individuals directly and indirectly affected by extreme floods. Better recognition and treatments for anxiety, depression, grief, loss, cognitive or social dysfunction and coping deficits are needed. Research on treatments for the flood victims, the families of the flood victims, and the caregivers are desperately needed. Gender questions must continue to be asked concerning individual and family recovery. Fordham's work (1998) comparing how different activities take place in the private and public spheres must be continued. Prior research emphasis on the public spheres has left out a great deal of what happens in long-term flood recovery in the home and outside the official record. Gender related studies show the importance of participatory approaches to local planning. Research must account for varying perspectives within the community. This paper reveals how little is known about the long-term impacts of any disasters, including floods. Extreme floods will continue to occur. It behooves the research community to better understand how to mitigate the social losses associated with these events. The first questions considered must define long-term, and social and economic impacts so events can be compared over geographic place and time. Do floods make any difference to how a community develops and changes through time? We will need a complex and comprehensive research effort to adequately address this question with any authority.

- FINAL THOUGHTS. Many disaster experts recognize that there are no natural disasters. All disasters have social and technological contexts. While heavy prolonged rains contribute to extreme floods with long-term impacts, not all unusually heavy rains have catastrophic consequences. People in poverty are more vulnerable because they live in hazardous areas including floodplains and steep hillsides. They have fewer resources and this lack of resources affects all levels of the disaster vulnerability. They are less likely to receive timely

warnings and they have fewer options for reducing losses even if a warning does arrive in a timely fashion. Poverty is also linked to resilience and speed of recovery. Disaster prevention needs to address economic and political issues, not only geological and meteorological aspects. The links between social and physical science must be developed. These links will help in the assessment of the actual long-term impacts of extreme floods and other disasters. There must be a wholesale shift in the underlying philosophy of disaster relief agencies (Walker 1994:9). The recognition of the inequitable distribution of vulnerable populations must be recognized and research efforts and policies must account for the spatial distributions if actual reductions in disaster losses are to occur. There also must be vast reconsideration of long term policies for flood mitigation for rivers that experience slow-rise or flash floods if the spiraling economic and social costs, or even the increases in annual costs, are to be reduced. Nothing short of a thoughtful and critical revamping of land use polices at all scales holds promise for reduced loss of lives and property.

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