Quick Response Report #95
THE IMPACTS OF A SECOND CATASTROPHIC FLOOD ON PROPERTY VALUES IN LINDA AND OLIVEHURST, CALIFORNIA

Graham A. Tobin
Department of Geography
University of South Florida
Tampa, Florida 33620-8100
and
Burrell E. Montz
Department of Geological Sciences and Environmental Studies
Binghamton University
Binghamton, New York 13902-6000

1997

Return to Hazards Center Home Page
Return to Quick Response Paper Index

This material is based upon work supported by the National Science Foundation under Grant No. CMS-9632458. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

THE IMPACTS OF A SECOND CATASTROPHIC FLOOD ON PROPERTY VALUES IN LINDA AND OLIVEHURST, CALIFORNIA

INTRODUCTION

Natural hazards researchers have tried to trace the various social and economic impacts of different disasters by examining changing property values in hazardous areas. Some researchers have looked at earthquakes (Brookshire, et al., 1985; Palm, 1982; Scawthorn, et al., 1982) while others have focused on floods and floodplain locations. (Babcock and Mitchell, 1980; Burby and French, 1981; Changnon, et al., 1983; MacDonald, et al., 1987; Muckleston, et al., 1981; Sheaffer and Greenberg, 1981). These studies have essentially had the same goal of modeling disaster impacts, but their methods have differed and the findings have often been contradictory. For instance, while it would seem reasonable to hypothesize that an event like flooding would have a negative effect on house values, this has not always been supported by the literature (Muckleston, et al., 1981). This research theme has not been limited to the United States. Studies in Australia (Lambley and Cordery, 1991) and New Zealand (Montz, 1992) demonstrated an immediate depreciating effect following disaster events with some continued impact over the longer term. However, these studies also pointed out problems associated with trying to separate hazard-related impacts from market impacts relating to other socioeconomic and environmental variables.

It was in light of these studies, and particularly the confounding results, that the authors embarked on a comprehensive assessment of the relationships between flooding and property values beginning with Linda and Olivehurst, California (Montz and Tobin, 1986). Preliminary research findings demonstrated an inverse relationship between residential property values and the incidence of flooding; to wit, flooding does have a negative impact on property values under *most* circumstances (Montz and Tobin, 1987, 1988; Tobin and Montz, 1988). However, it was established that local context was also important in determining the degree of impact, both in terms of the physical attributes of the flood event itself, and the socioeconomic traits of the communities involved (Tobin and Montz, 1994). Specifically, this research revealed the existence of housing submarkets, defined by flood depths, within the floodplain (Tobin and Montz, 1994). The earthquake hazard also illustrates the importance of submarkets, wherein older brick buildings that do not meet building standards regarding earthquake safety comprised a submarket (Alesch and Petak, 1986). Submarkets were also identified in the communities studied in Australia and New Zealand. However, most studies have been short-term and were related to single events; what remains to be documented is the longevity of these submarkets.

THE THEORETICAL FOUNDATION

The conceptual framework for this work was presented in Tobin and Newton (1986) and is depicted in Figure 1. Briefly, the graph presents three scenarios following a flood (or other event). Immediately following a flood, property values decrease because the utility that can be derived from that parcel of land is reduced. Depending upon the nature of the flood in terms of frequency and magnitude, recovery can follow any of several paths, three of which are presented here. Line A represents a situation where frequent flooding may keep land prices low relative to non-flood areas. While the trend in property values may not be entirely flat, any increases that may occur are negated by the next flood. Line C represents the opposite situation, that of extreme flooding, either an infrequent, perhaps a "once-in-a-lifetime" event, or catastrophic flooding, or both. In this case, it is expected that property values will decrease immediately after the event, but will recover eventually to pre-flood levels, and perhaps rise even higher. Under other circumstances, property values might recover over a time-frame somewhere in between these two extremes (line B).

Research to date has verified aspects of this model. For instance, Des Plaines, Illinois is a community that experiences relatively frequent flooding. Although other dynamics of the real estate market had a significant impact in this Chicago suburb, capitalization of the flood hazard was apparent after the community experienced two floods within a 10 month period, and five floods within 50 years (Tobin and Montz, 1990). Similarly, in Wilkes-Barre, Pennsylvania, properties flooded more than 9 feet in a catastrophic event in 1972 virtually replicate line C on the graph in Figure 1. However, properties flooded less than 9 feet (the mid-range depth for this event) recovered rather quickly, and prices exceeded pre-flood values within one year of the flood (Montz and Tobin, 1990). Thus, empirical evidence from several study areas tends to support the theoretical base, though there are variations from what was expected in some submarkets.

The Study Area - Linda and Olivehurst, California

Previous work in Linda and Olivehurst also serves to validate the submarket findings. For example, the decrease in sold prices immediately following the 1986 flood was followed by recovery to almost pre-flood prices for those properties flooded to 18 inches, in keeping with the model. However, properties flooded to 10 feet or more experienced some recovery after the initial drop, but prices never got higher than 80% of pre-flood levels, and later they experienced another decline (Montz and Tobin, 1988). Therefore, it appeared that the flood was indeed capitalized in property values, as hypothesized, and the data on non-flooded property supported this contention. Furthermore, characteristics of the flood were to some extent instrumental in determining land values as shown by the different residential submarkets. However, these findings were confined to the immediate two-year, post-flood period. An examination of a longer time period, therefore, would permit further evaluation of the extent to which the model continues to apply and would provide a longitudinal test of the concept of capitalization of the flood.

The opportunity to explore this more fully arose in January 1997 when not only a second, but also a third "once-in-a-lifetime" event occurred in the same communities as a result of two levee breaks. The levee systems have been compromised on several previous occasions. For example, in 1955, Yuba City was flooded when a Feather River levee failed; in 1986 another levee break north of Linda allowed flood waters to inundate large areas of Linda and Olivehurst, and most recently the 1997 events. Furthermore, the relatively flat topography has only exacerbated the extent of flooding once the levees failed.

The 1997 floods raised several interesting questions. First, how would the second and third catastrophic floods in 11 years affect property values in the newly flooded areas? Given that two floods in less than a month represent very frequent flooding, they may, in fact, be so close in time as to act as one event with regard to impacts on property values. Second, the recent floods have all been associated with levee breaks, which calls into question the efficacy of the local flood control strategy along with use of the floodplain. Finally, it has been suggested that frequent events would lead to continuously depressed property values while low-probability, catastrophic events would allow prices to return relatively rapidly to pre-event levels. The impacts on property values of two large events in such close temporal proximity has not been examined. Furthermore, the 11-year lapse between events may be sufficiently close to the period in which past events might be forgotten, and hence the situation provides an occasion to test the expectation theory postulated by Yezer and Rubin (1987).

METHODOLOGY

The situation in the Yuba City/Marysville area provided an ideal opportunity to further these studies. Two goals emerged; the first focused on the new flooded areas (1997), and second concerned the 1986 flood zones. In the first instance, the goal was to test previous findings regarding the immediate impacts of flooding of residential land values. It was recognized that this component would entail collecting important background data on the residential housing market for a longer-term study. The second goal involved a re-evaluation and updating of the old flood zone data to (i) examine the length of the recovery period for residential real estate market following catastrophic flooding and (ii) test further the significance of the residential submarkets over the long-term. Thus, the research focused on both short and long-term perspectives of catastrophic flooding.

Goal One

To replicate the research methodology undertaken in 1986, data on individual house sales for the preceding two years for property located in the newly flooded area and for comparable property located immediately outside the flooded area were obtained from the Multiple Listing Service Sold Books. These books include approximately 95% of all house sales in the area. Data were also collected on house sales that were still pending. Specific data included not only the address, but also details on house size, number of bedrooms and bathrooms, age of the structure, days the property had been on the market, and both the list and sold prices. These data were then compared with those for the 1986 flood, and also set the stage for a longitudinal analysis of the effects of the 1997 floods on residential property values.

Additional data were collected on the physical attributes of the flood itself, especially details on depth, duration, extent, speed of onset, and timing. This information was obtained from Internet sites, field reconnaissance, damage surveys of residential property, consultation with community officials responsible for dealing with the impacts of the floods, local newspapers, and from meetings with real estate agents and the Board of Realtors.

Goal Two

To assess the longevity of flood impacts, property values were tracked since the previous studies to determine longitudinal patterns. In order to evaluate relationships between the degree of flood experience and impacts on house prices, residential areas in Linda and Olivehurst had been divided into three spatial areas: those neighborhoods flooded to 18 inches, those flooded to 10+ feet, and non-flooded areas. Again, data on house listings and sales were obtained from the Multiple Listing Service records of the Sutter-Yuba Board of Realtors, for the period January, 1983 (to establish the pre-flood market) until December, 1996. Unfortunately, the Board of Realtors was unwilling to make available pre-flood data on non-flooded properties, though an estimate of median selling price was offered.

Chi square analyses of housing characteristics between and within the flooded neighborhoods, undertaken for the earlier studies, showed no significant differences among the flooded neighborhoods, thus verifying the homogeneity of the tract developments (Montz and Tobin, 1988). Consequently, controls on differences in housing type and size are embedded in the sample. Non-flooded houses were more dispersed throughout the communities, and therefore not as uniform, but Chi square analysis of housing characteristics (number of beds and baths, and square footage) resulted in no significant difference for pre-flood conditions between the flooded and non-flooded areas. All list and sold prices were converted to 1984 dollars, using the CPI housing index.

RESULTS
The Floods
As stated above, the 1986 flood in Linda and Olivehurst, California, was triggered by a levee break along the Yuba River (Figure 2). Prior to this event, recent flooding in the area had affected the communities of Marysville and Yuba City, on the other side of the Feather and Yuba Rivers, while Linda and Olivehurst received only localized storm damage. The 1986 flood was devastating, affecting approximately 6500 buildings in the two communities, which, in 1990, had a combined population of approximately 22,000. The floodplain in this area is extensive, with levees virtually ringing the two towns, along the Feather, Yuba, and Bear Rivers. Because of the levee break, water flowed rapidly into the towns; because of the level topography it slowed in velocity, but increased in depth, to over 10 feet in places. And, the level topography caused the water to remain in some places for more than two weeks. Thus, damage resulted from both rapid water velocities and from the long duration of saturation. In the end, more than 3,000 homes were damaged and 895 destroyed. Total public and private losses were estimated at $22,500,000 (Teets and Young, 1986).

A similar scenario occurred in 1997. Heavy rainfall during December 1996, caused the Feather River to rise rapidly, peaking at 78.23 feet on January 2, and to remain above warning stage (65 feet) until January 7 (California Department of Water Resources, 1997). Yuba City and Marysville did not flood because the levee system protects the two communities up to 80 feet. Nevertheless, flooding ensued in Olivehurst, just to the south, as shown in Figure 3, following a levee break on January 2 (the Country Club break). Another levee gave way three weeks later and caused additional flooding of some of the same areas (the Bear River break). It is interesting to note that these levees had been scheduled for repair by May 1999 following the previous flooding in 1986 (Vogel, 1997).

On this occasion, water inundated approximately 450 houses, many businesses, and extensive farmland areas. Numerous houses were flooded to depths in excess of 10 feet and many were damaged beyond repair. Those closest to the breaks were generally destroyed by the tremendous force of water rushing through the gaps, and a local newspaper reported that water surging through the levee break had been over 30 feet deep (Vogel and Cox, 1997). Farther away from the break, the water, while still deep, did not cause such visible destruction; houses were still standing and outer structures appeared to be intact. However, invariably with flooding of this depth and duration, interior walls get saturated and rot away and hence have to be removed. Losses, therefore, are expected to mount. Some home owners had begun to repair damage from the January 2 event when they were flooded again. By the end of January, some of the houses flooded to lesser depths were being repaired, although, the visual marks of the flood were evident in most areas, and few residents had finished cleaning up from either (or both) floods.

During the 1997 flooding over 38,000 Yuba County residents were evacuated, including virtually everybody in the town of Marysville. Nearly 1000 acres of residential land, 15,500 acres of farmland and orchards, and 1700 acres of industrial land in Yuba County were flooded. In all, 322 homes were destroyed, 407 suffered major damage, and 69 minor damage. Sixty-three mobile homes were destroyed, 12 suffered major damage and 3 minor damage, and 7 apartments were also affected by the flooding (Dunstan, 1997). Forty-six emergency shelters were operating in the area; 20 of these were in Yuba County and 10 in Sutter County, and they provided shelter for 15,120, and 8,506 people respectively.

By mid-January, economic losses were estimated officially at over $300 million, with $55 million accruing from damaged homes, nearly $63 million from agricultural losses, and over $100 million from industry. The costs to repair roads was estimated to run to $23 million, and levee repairs another $15 to $20 million. The clean-up of debris was over $300,000. In addition, there were three deaths attributed to the flooding (Dunstan, 1997).

The Residential Housing Market - The New Flood Zones

An initial survey of residential properties in the Olivehurst area showed that the 1997 flood had, for the most part, affected larger and more expensive housing than the 1986 flood. Table 1 shows the difference in square footage between the 1986 and the 1997 properties.

The flooded area in 1997 was separated into three potential submarkets based on flood depth, since flood depth had been found to be a significant variable in determining house sold prices in previous studies: those houses flooded up to 2 feet; those properties flooded between 2 and 4 feet, and those properties flooded up to the rooftops. Because no properties had sold in the month following the floods, comparisons were made between sold property located within the flood zone and residences flooded in 1986 to establish trends and to compare areas affected (Tables 2 and 3). Research is continuing to track changes in house values over the coming years.

Statistics on list prices and sold prices demonstrate that properties in the 1997 flood were generally more expensive than in the 1986 flood zone. Furthermore, the decline from median list price to median sold price was more for the 1986 flood submarkets (10.74%, 2.04% and 6.73% respectively) than for the 1997 flood submarkets (1.09%, 3.77% increase, and 3.19% respectively) at least for the 11 years of record. (Note that these data include only prices before the 1997 floods). Indeed, the difference between sold prices is significant based on an examination of the data comparing median sold prices for each flood and non-flood zone (Table 4). For instance, 68% of flooded properties in 1986 sold below the median price for houses in that submarket, compared to 55% of non-flooded properties and only 29% of the 1997 flood properties. The next step is to investigate how the recent floods have impacted property values in both the new and old flood zones.

It is probable that the recent flood might make the housing market more dynamic than it had been over the preceding six months because so many houses had been destroyed during the flooding, which in turn would increase the demand for dwellings in the local vicinity. The President of the Board of Realtors supported this contention, as did other real estate agents, indicating that the market for houses in non-flooded areas, especially around the Yuba-Sutter Buttes, had already shown signs of increasing (Leighton, 1997).

The Residential Housing Market - The Old Flood Zones

The graph in Figure 4, depicts the different experiences of each flood submarket following the 1986 event, and demonstrates that the flood did, indeed, have an impact on sold prices that varied depending upon depth of flooding. Properties flooded to more than 10 feet experienced a significant, and immediate post-flood decline in sold prices, such that even after one year, prices were almost 30% lower than pre-flood levels. An increase by the end of the second year probably reflected investments in repairs and the resale of houses (Montz and Tobin, 1988; Tobin and Montz, 1988). But this did not last, as prices fell again over the next two years only rebounding somewhat at the end of the 10-year period. In contrast, the sold prices for houses flooded to 18 inches reproduced the theoretical pattern presented by line B in Figure 1. Prices fell immediately following the flood, but then gradually increased over time, and ended the period with the highest proportional increase. Non-flooded houses also experienced a post-flood decline, perhaps contrary to what might be expected, although this may have reflected a general lack of interest in the housing market of Linda and Olivehurst after such a catastrophic event.

CONCLUSIONS - FURTHER RESEARCH

Evidence immediately following the 1997 floods suggests that there has been an impact on the residential real estate market, primarily by encouraging some individuals to move off the perceived floodplain. On the other hand, the flood has also had a negative impact in those areas flooded to the greatest depths, at least over the short term. The housing market is virtually non-existent in this flood zone, a situation that is comparable with the 1986 event. The president of the Board of Realtors also feared that many businesses would relocate to "safer" areas while others would not come to Yuba/Marysville area because of the publicity, thus compounding the economic woes of the communities. This is a valid point. News media had indicated that virtually all of Yuba City and/or Marysville was under water at some time and in fact nearly all residents in Marysville had been evacuated. Yet, no serious flooding occurred in Yuba City or Marysville and only parts of Olivehurst were inundated.

Pre-flood values of houses affected by the 1997 floods indicate that, overall, this is a somewhat more affluent area than the neighborhoods flooded in 1986, even when the effects of the 1986 flood are taken into account. Indeed, new residential development near the Plumas golf course was planned before the levees broke, and existing housing in that area tends to be larger and more expensive than houses elsewhere in the communities. Whether or not these trends continue, with distinct differences between flood zones, is the focus of continued research. Thus, the 1997 floods open new opportunities for evaluating the longitudinal effects of flooding and for comparing impacts among neighborhoods and between flood events. Results from the long-term analysis of properties flooded in 1986 suggest that differences between flooded areas will continue. However, the properties flooded to the greatest depths in 1986 started out at the same value as those with lower flood depths. In 1997, more expensive homes experienced the greatest depths. Their recovery may differ from the 1986 experience as a result, perhaps facilitated by the high pre-flood values. Research is continuing to track these trends.

A second avenue of research was raised by both the County Administrator and the President of the Board of Realtors, who suggested the possibility that psychological stress might accrue within the Yuba and Marysville areas because faith in the levees had been severely compromised. It would be worth tracking, therefore, (i) if this is indeed true; (ii) if true, how long this perception persists; and (iii) whether this belief has any impact on location/relocation choices regarding housing. It is probable, for instance, that a proposed estate of 1200 houses will no longer be built in the Olivehurst area.

Longevity of Impacts - the Recovery Period

From the data collected it was possible to track changes in property values since the 1986 flood to set up longer term analyses of house prices for the next few years. This should result in a better understanding of the effects of flooding on the residential land market. Earlier research showed that repairs to flooded properties may influence recovery such that properties with greater flood depths would perhaps recover more quickly because there were more extensive repairs and, thus, upgrading and updating of houses (Tobin and Montz, 1994). This did not appear to be the case, over the longer term. Properties that experienced flooding in 1986 did eventually recover to near pre-flood levels, but the length of time that this recovery took varied with depth of flooding. When compared to immediate post-flood values, houses with lower flood levels recovered more quickly and exhibited a greater increase in sold prices. For houses experiencing greater depths, the recovery period was in excess of 10 years, confirming that the flood had been capitalized into property values in spite of the repairs.

Despite the once-in-a-lifetime nature of this flood, the spatial variations in recovery demonstrated that the effects are long-lasting. Indeed, the submarkets classified after the 1986 flood remained identifiable over the long term. Part of this may be due to the fact that not all properties in the areas with greatest flood depths were repaired. For many years after the 1986 flood, some houses remained abandoned. Certainly this has been a constant reminder of the flood for potential buyers, in addition to the depreciating effect such properties can have on surrounding property values. Hence, although the expectation of flooding has probably been low, given the nature of the 1986 flood, the reminders that exist in the communities influence recovery and this perpetuates the submarkets. Of course, the 1997 events have further compounded the situation and will provide another element to the longitudinal study of these areas.

REFERENCES

Alesch, D.J. and Petak, W.J. 1986.
The Politics and Economics of Earthquake Mitigation: Unreinforced Masonry Buildings in Southern California. (Monograph 43) Program on Environment and Behavior: Boulder, Colorado: Institute of Behavioral Science, University of Colorado.

Babcock, M., and Mitchell, B. 1980.
Impact of Flood Hazard on Residential Property Values in Galt (Cambridge), Ontario. *Water Resources Bulletin* 16(2):532-37.

Brookshire, D.S., Thayer, M.A., Tschirhart, J., and Schulze, W. D. 1985.
A Test of the Expected Utility Model: Evidence From Earthquake Risks. *Journal of Political Economy* 92:369-89.

Burby, R.J., and French, S.P. 1981.
Coping with Floods: The Land Use Management Paradox. *Journal of the American Planning Association* 47:289-300.

Changnon, S.A., Schicht, R.J., and Semonin R.G. 1983.
A Plan for Research on Floods and Their Mitigation in the United States. In *Final Report to National Science Foundation* (NSF-PAG-81-17027).

California Department of Water Resources. 1997.
California Data Exchange Center. http://cdec.water.ca.gov/.

Dunstan, J.C. 1997.
Personal Communication. County Administrator, County Administrators Office, Yuba County.

Lambley, D.B. and Cordery, I. 1991.
Effects of Floods on Housing Markets in Sydney. In *Proceedings of International Hydrology and Water Resources Symposium*, 1991, Perth, Australia. pp. 863-866.

Leighton, L. 1997.
Personal Communication. President of the Yuba-Sutter Board of Realtors, Yuba City, California.

MacDonald, D.N., Murdoch, J.C., and White, H.L. 1987.
Uncertain Hazards, Insurance and Consumer Choice: Evidence from Housing Market. *Land Economics* 63:361-371.

Montz, B.E. 1992.
The Effects of Flooding on Residential Property Values in Three New Zealand Communities. *Applied Geography* 13(3): 225-242.

Montz, B.E. and Tobin, G.A. 1986.
Spatial and Temporal Variability in Residential Land Values Following Catastrophic Flooding. *Quick Response Reports*, 17. Natural Hazards Research and Applications Information Center, University of Colorado, Boulder.

Montz, B.E. and Tobin, G.A. 1987
Real Estate Agents and Post Flood Recovery: Implications for Floodplain Management. In *Realistic Approaches to Better Floodplain Management*, The Association of State Floodplain Managers and Natural Hazards Research and Applications Information Center, Special Publication, No. 18, pp. 111-119. Boulder, Colorado.

Montz, B.E. and Tobin, G.A. (1988)
The Spatial and Temporal Variability of Residential Real Estate Values in Response to Flooding. *Disasters: The Journal of Disaster Studies and Management* Vol. 12, No. 4, pp. 345-355.

Montz, B.E. and Tobin, G.A. 1990.
The Impacts of Tropical Storm Agnes on Residential Property Values in Wilkes-Barre Pennsylvania. *The Pennsylvania Geographer* 45(2): 336-341.

Muckleston, K.W., Turner, M.F., and Brainerd, R.T. 1981.
Floodplain Regulations and Residential Land Values in Oregon. Office of Water Resources Technology (No. A-054-ORE) and Water Resources Research Institute, Oregon State University, Corvallis, Oregon.

Palm, R. 1982.
Earthquake Hazards Information : The Experience of Mandated Disclosure. In *Geography and the Urban Environment: Progress in Research and Applications*, ed. D.T. Herbert and R.J. Johnston, 5:241-77. Chichester: Wiley.

Scawthorn, C., Iemura, H., and Yamada, Y. 1982.
The Influence of Natural Hazards on Urban Housing Location. *Journal of Urban Economics* 11:242-51.

Sheaffer, J.R., and Greenberg, L.S. 1981.
Evaluation of the Economic, Social and Environmental Effects of Floodplain Regulations. U.S. Department of Housing and Urban Development and Federal Emergency Management Agency, Washington, D.C.

Teets, B. and Young, S. 1986.
Rivers of Fear: The Great California Flood of 1986. Terra Alta, WV: C.R. Publications, Inc.

Tobin, G.A. and Montz, B.E. (1988)
Catastrophic Flooding and The Response of the Residential Real Estate Market. *The Social Science Journal* Vol. 25, No. 2, pp. 167-177.

Tobin, G.A. and Montz, B.E. 1990.
Response of the Real Estate Market to Frequent Flooding: the Case of Des Plaines, Illinois. *Bulletin of the Illinois Geographical Society* 23(2): 11-21.

Tobin, G.A. and Montz, B.E. (1994)
The Flood Hazard and Dynamics of the Residential Land Market. Water Resources Bulletin, Vol. 30, No. 4, pp. 673-685.

Tobin, G.A. and Newton, T.G. (1986)
A Theoretical Framework of Flood Induced Changes in Urban Land Values. *Water Resources Bulletin* Vol. 22, No. 1, pp. 67-71.

Vogel, N. 1997.
Ancient Levees Targeted. *Sacramento Bee* January 8.
http://www.sacbee.com/news/floods/.

Vogel, N., and J.D. Cox. 1997.
The Thin Weak Links of Flood Control. *Sacramento Bee* January 8.
http://www.sacbee.com/news/floods/.

Yezer, A.M., and Rubin, C.B. 1987.
The Local Economic Effects of Natural Disasters. *Institute of Behavioral Science Working Paper* No. 61, Natural Hazard Research and Applications Information Center, University of Colorado.

Tables

TABLE 1: Comparison of House Sizes for 1986 and 1997 Flood Zones

Flood Zone	<1,000 sq.ft.		1,000-1,300 sq.ft.		>1,300 sq. ft.		Total
Flood Area '86	77	43%	67	38%	34	19%	78
Flood Area '97	6	13%	20	42%	22	46%	48
Total	83	37%	87	39%	56	25%	226

TABLE 2: Comparison of House List Prices - 1986 and 1997 Flood Zones

Submarkets	N	Max $	Min $	Mean $	Median $
Rooftops '86	71	69,923	18,439	45,028	46,596
18 Inches '86	62	64,352	38,009	49,641	49,046
10 Feet '86	45	65,004	29,282	52,190	52,795
Not Flooded	108	77,900	19,437	51,026	51,916
< 2 Feet '97	13	67,760	34,001	53,939	57,212
2-4 Feet '97	17	87,940	31,922	63,073	59,193
> 4 Feet '97	18	196,416	40,706	103,548	103,503

(1984 $ values)

TABLE 3: Comparison of House Sold Prices - 1986 and 1997 Flood Areas

Submarkets	N	Max $	Min $	Mean $	Median $
Rooftops '86	46	69,014	13,582	41,902	41,593
18 Inches '86	47	61,856	30,864	47,166	48,044
10 Feet '86	40	65,004	17,921	50,319	49,240
Not Flooded	101	77,000	16,124	48,133	48,728
< 2 Feet '97	12	66,129	33,619	51,809	56,588
2-4 Feet '97	15	86,086	22,727	62,935	59,416
> 4 Feet '97	17	193,662	33,921	96,833	100,200

(1984 $ values)

TABLE 4: Median House Sold Prices as a Function of Flood Zone

Flood/Non-Flood Zones	Median Sold Price		Total		
Flood Area '86	121	68%	57	32%	178
Non-Flooded	56	55%	45	45%	101
Flood Area '97	14	29%	34	71%	48
Total	191		136		327

X2 = 20.8, df = 2, p<.001

Figures

FIGURE 1: Theoretical Framework Outlining the Potential Impact and Subsequent Recovery of Land Values Following a Disasters.

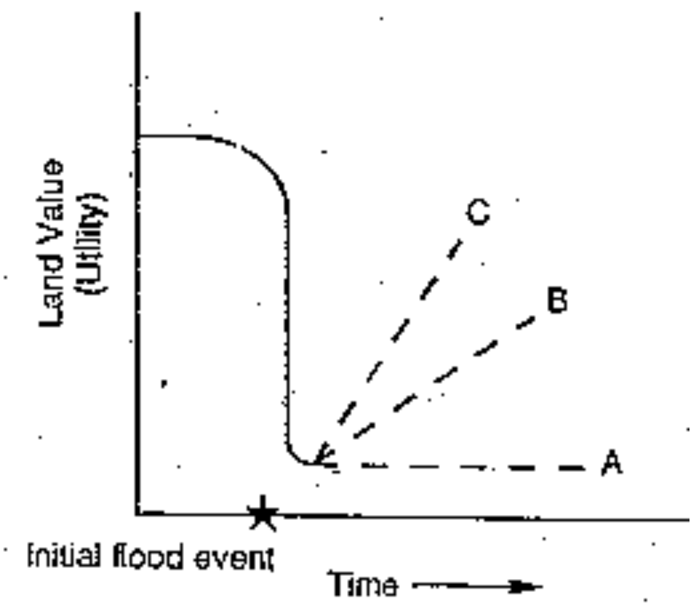


FIGURE 2: Extent of Flooding in Linda and Olivehurst, California in 1986.

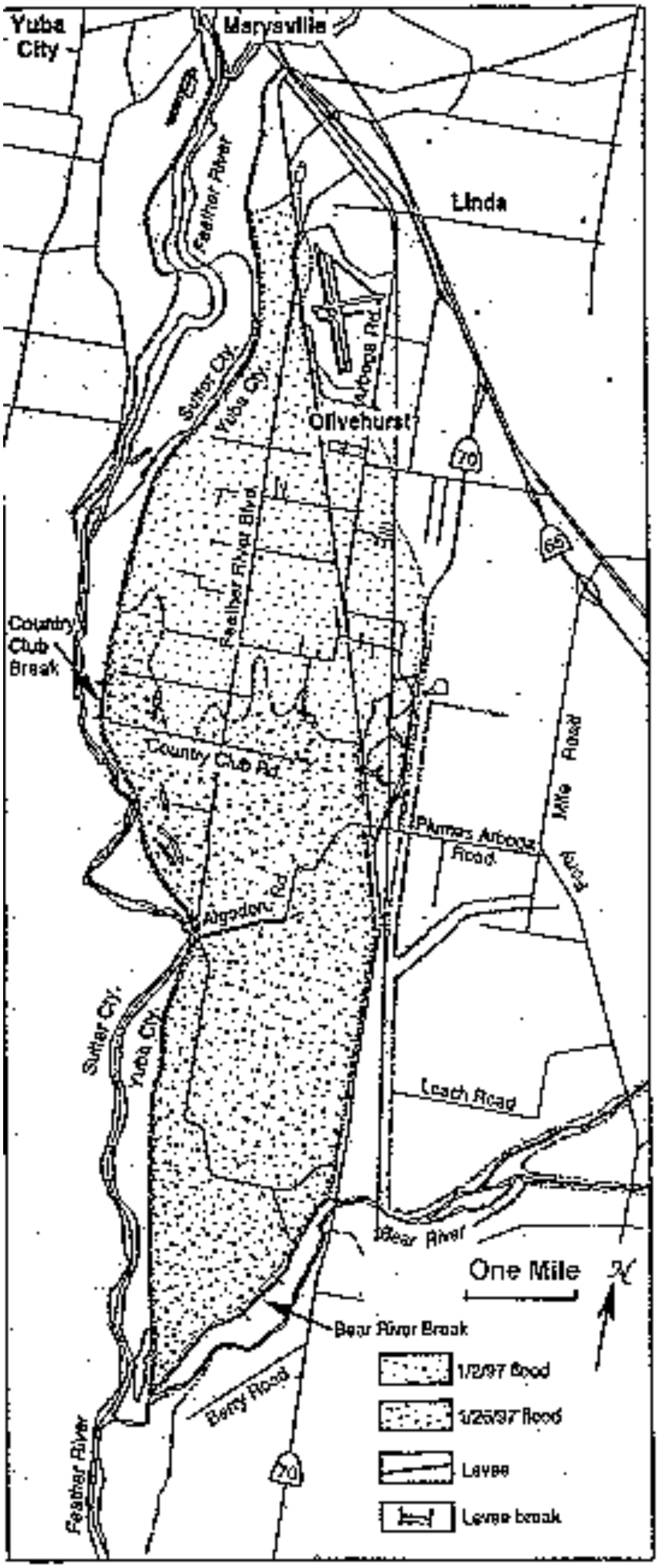

Yuba City
Marysville
Linda
Feather River
Sutter Cty.
Yuba Cty.
Arboga Rd.
Olivehurst
70
65
Feather River Blvd.
Country Club Break
County Club Rd.
Plumas Arboga Road
Mile Road
Algodon Rd.
Sutter Cty.
Yuba Cty.
Leach Road
Bear River
One Mile
N
Bear River Break
Berry Road
70
Feather River
1/2/97 flood
1/25/37 flood
Levee
Levee break

FIGURE 3: Extent of Flooding in Linda and Olivehurst, California in 1997.

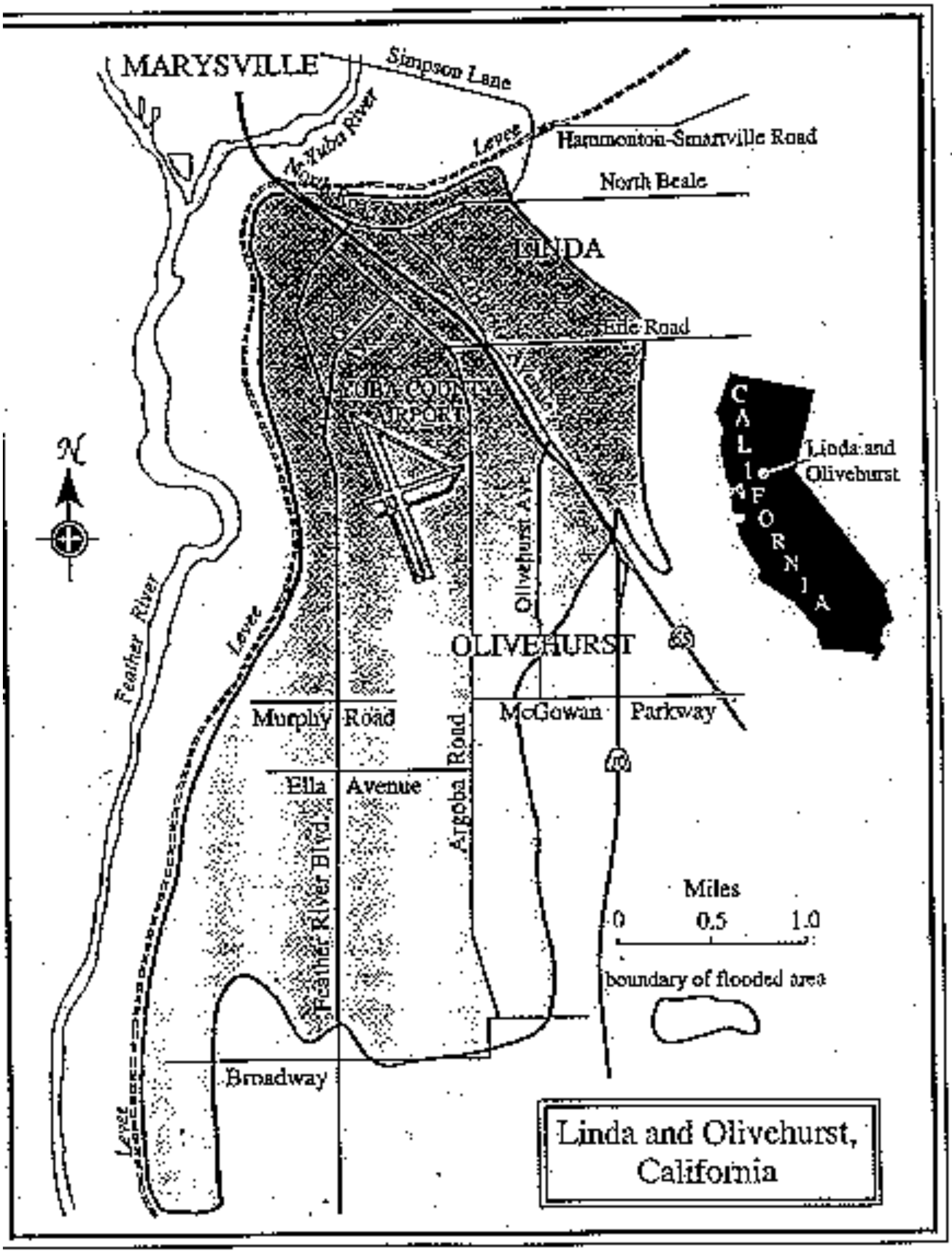
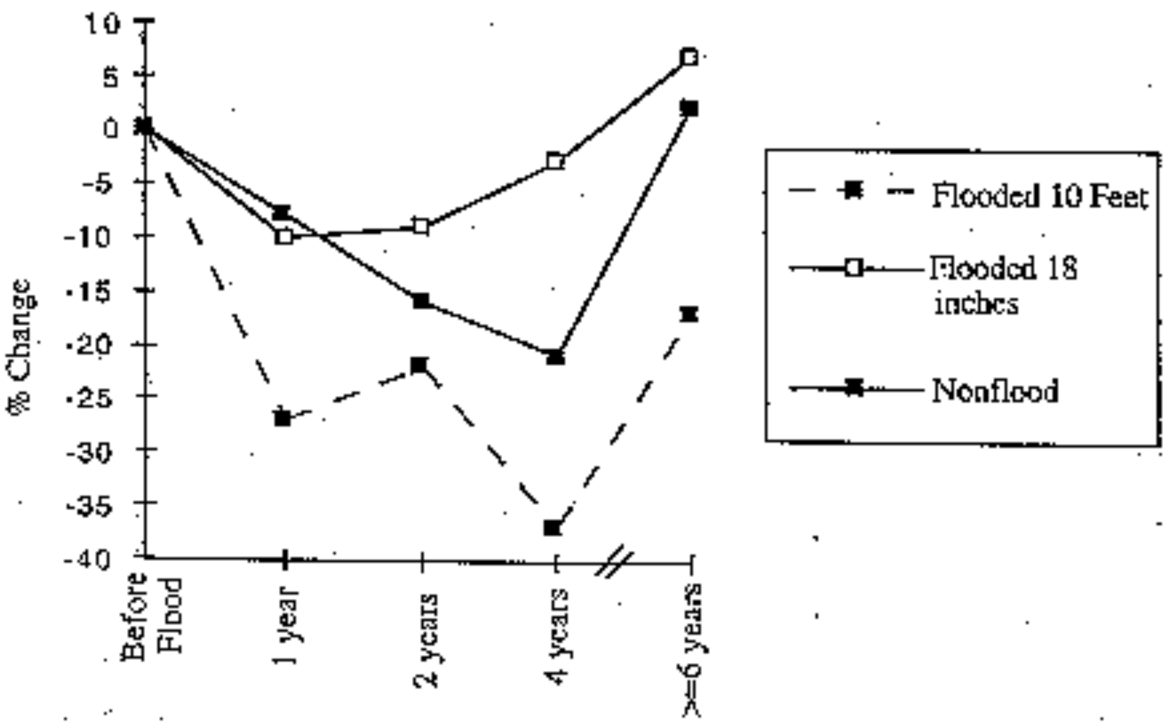


FIGURE 4: Changes in House Sold Prices Following the 1986 Flood in Linda and Olivehurst, California.



[Return to Hazards Center Home Page](#)

October 8, 1997

hazctr@colorado.edu