Natural Hazard Research

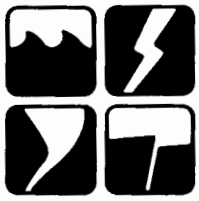
THE CONSEQUENCES OF LARGE-SCALE EVACUATION FOLLOWING DISASTER: THE DARWIN, AUSTRALIA CYCLONE DISASTER OF DECEMBER 25, 1974

J. Eugene Haas
Professor of Sociology
Institute of Behavioral Science
University of Colorado
Boulder, Colorado 80302

Harold C. Cochrane
Assistant Professor
Department of Economics
Colorado State University
Fort Collins, Colorado 80521

Donald G. Eddy
Regional Director
Federal Disaster Assistance Administration
Lincoln Tower Building
1860 Lincoln, Room 1140
Denver, Colorado 80203

July, 1976



Working Paper #27

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

The brief study reported here was undertaken at the request of Mr. Thomas P. Dunne, Administrator, Federal Disaster Assistance Administration, U.S. Department of Housing and Urban Development. The two-week data collection period in Australia began March 10, 1975, some 2 1/2 months after the Darwin disaster. Enthusiastic cooperation and support was received from the U.S. Embassy in Canberra, especially Robert Montgomery, and at all levels of government in Australia. Discussions and interviews were held in Canberra, Brisbane, Darwin, Adelaide and Melbourne. With only minor exceptions, friendliness and candidness were the principal characteristics of our discussions. We are indebted to several dozen officials, some fifty business executives, and to thirty-five families in Darwin, Adelaide, and Melbourne for their time and insights.

PREFACE

This paper is one in a series on research in progress in the field of human adjustments to natural hazards. It is intended that these papers will be used as working documents by the group of scholars directly involved in hazard research as well as inform a larger circle of interested persons. The series was started with funds granted by the U.S. National Science Foundation to the University of Colorado and Clark University but now is on a self-supporting basis. Authorship of papers is not necessarily confined to those working at these institutions.

Further information about the research program is available from the following:

Gilbert F. White
Institute of Behavioral Science
University of Colorado
Boulder, Colorado 80302

Robert W. Kates
Graduate School of Geography
Clark University
Worcester, Massachusetts 01610

Ian Burton
Institute for Environmental Studies
University of Toronto
Toronto, Ontario, Canada

Requests for copies of these papers and correspondence relating directly thereto should be addressed to Boulder. In order to defray production costs, there is a charge of $2 per publication on a subscription basis or $3.00 per copy if ordered singly.

INTRODUCTION

This report is designed to answer several specific questions (see enclosure 1) concerning the massive evacuation of Darwin, Australia, beginning on December 26, 1974. Although our assignment was restricted to the evacuation itself--the decision to evacuate, the effect on families, and the influence on Darwins' economic life as well as reconstruction--we quickly became aware that for certain questions it would be impossible to separate the effects of the evacuation from the physical destruction wrought by the disaster itself. For example, does any alteration in the economic life of Darwin flow from the massive destruction of the region's economic base or is it a result of the evacuation? Obviously both factors are linked in an integral way to the changes in the economy which are already occurring.

Because background information on the warning, the damage, and the return of evacuees was thought to be useful in setting the stage for a discussion of the evacuation, data collected concerning these facets of the Darwin disaster are also provided in this report.

Finally, because of Darwin's uniqueness--its remoteness, its heavy reliance upon government employment--some of the findings which flow from this experience may not be readily applicable to American disasters. As a result, we have attempted in the concluding section of this report to present <u>all</u> the findings and then isolate those which may prove to have direct relevance to the operations of the Federal Disaster Assistance Administration.

BACKGROUND

The City of Darwin, population approximately 47,000, is geographically isolated. It is more than 1800 miles to the nearest city of any size in Australia. Situated near the northernmost tip of the continent, the climate is tropical. In recent years the city has been growing at the rate of 7-10% per year. An estimated 20-25% are first generation immigrants, many from Greece and Italy. Another 25-30% are aboriginals or part aboriginals.

The largest segment of the labor force, 45%, is employed by the government, mostly civilians employed in the Department of the Northern Territory. The Northern Territory in which Darwin is situated has yet to achieve statehood and consequently most civil servants are Commonwealth employees.

More than 40% of the dwelling units in Darwin are either government owned or were built by the government and sold to civil servants. The type and quality of residential construction, therefore, is to a significant extent a reflection of government policy. Though there is variation, by far the most common residential structure is the single-story house built on one story high concrete pilings. There is very extensive use of louvered windows throughout.

For its size, Darwin is a sprawling city. It was founded in 1869 and experienced its greatest growth in the late 1960's (averaging 10%) in the Northern sections of Tiwi, Nakara, and Wanguri. Principal facilities include one large and several medium sized hotels/motels, one hospital, 26 schools, at least 40 public and private large office

buildings, and 5 shopping centers, in addition to the 8-block-long central business district.

The last destruction in Darwin came from Japanese bombs in World War II. The last significant damage from a cyclone occurred on March 10, 1937, long before most of the current inhabitants lived in Darwin. Many residents, however, had moved to Darwin from other Australian cities such as Sydney, Brisbane, and Townsville where the cyclone threat is a yearly event. Residents report being aware of perhaps three to five cyclone alerts every year. The distinction between an alert of watch versus a warning is simply not recognized by our respondents. Several weeks prior to Christmas Eve, 1974, a cyclone had moved into vicinity of Darwin but, as usual, it had continued southwest into the Indian Ocean, reinforcing further the "cry wolf" syndrome.

WARNING, IMPACT AND THE MORNING AFTER

In the late afternoon of Christmas Eve the skies looked ominous and the radio and TV stations reported periodically on the status of Cyclone Tracy. By early evening, the messages were beginning to include detailed instructions about preventive measures which should be taken. Still, most persons apparently believed that this cyclone, like so many previous ones, would miss Darwin at the last minute. Even those who took all reasonable precautions reported afterwards that they really did not think the storm would hit them. In retrospect, there was almost unanimous agreement that the warnings had been adequate. Officials in Canberra also held that view. Apparently evacuating to public shelters or out of the city entirely was simply not considered, except in a few instances.

In any event, families went about their usual Christmas Eve activities which, for most families, meant visiting in the homes of friends and relatives and having a few drinks. All but a few families monitored the progress of the storm throughout the evening. (See Figure 1 for a map of the storm's path.) At about 10:00 or 11:00 some of the visiting families decided to return to their own homes. They could observe the increasing intensity of the wind and rain and were worried that later they might not be able to get home due to fallen trees and power lines. Besides, the reports made it appear almost certain that the storm would really hit Darwin after all.

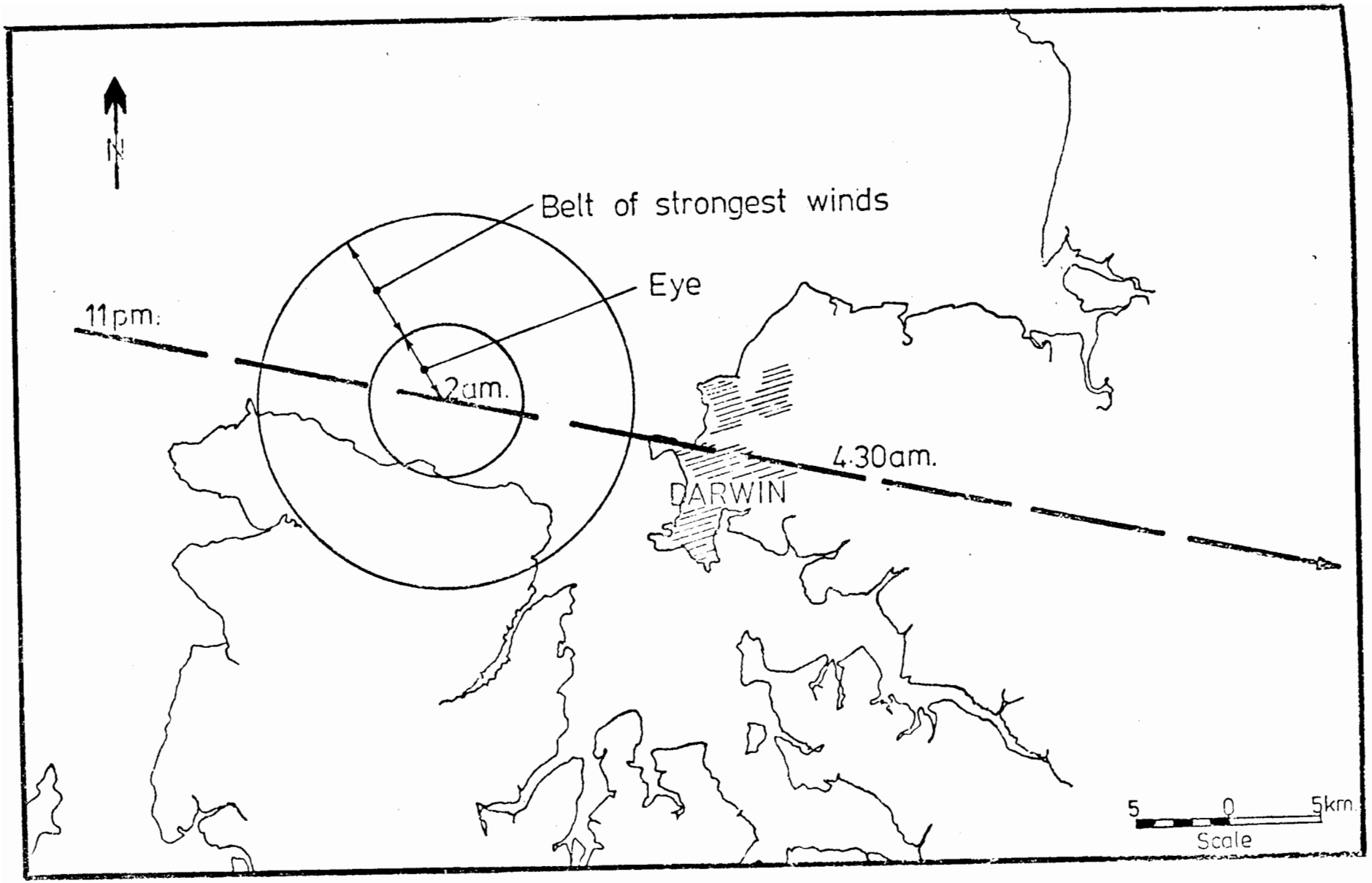


FIGURE 1

PATH OF CYCLONE TRACY ACROSS DARWIN (showing approximate size)

It was shortly after midnight when the first serious damage occurred. Louvered windows were shattered by flying debris, or simply collapsed from the force of the wind. Shortly thereafter roofs started to go, often section by section. Not only did every item in the house get wet, but many persons reported that from one to two inches of water built up on the floor.

Most families lost electric power for good at about the time the last radio station went abruptly off the air, 1:00 A.M., December 25. Then it was the occupants of each dwelling versus the fury of Tracy. Respondents reported an overwhelming sense of aloneness. They assumed that it was only in their immediate area that the storm was so vicious that buildings were being ripped apart. They simply couldn't believe that all of Darwin was "under attack".

There were several modes of attempt at survival. The early approach was to go to the rooms furthest from where the wind was hitting the house. Where possible they crawled under beds or huddled in corners with mattresses held over them for protection against flying glass and other debris. Everyone reported being very cold, apparently due to rapid evaporation from the extremely high winds.

Announcements during the warnings had urged use of the bathroom as a shelter. It was undoubtedly the most used room in Darwin that night. Guests, pets, and family members huddled together in the bathroom hoping that the walls would offer more protection than the others had. There were few roofs remaining on Darwin homes by 2:30 A.M. Children and adults in bathrooms had to sit or stand in several inches of water while watching the lightning flash overhead.

When the calm of the eye of the storm came, very few people were fooled. They remembered that the winds would change direction and return. While many used the respite to look around at what remained of the house with flashlights (torches), only a few ventured "outside" or made a run for another dwelling. The winds returned after ten to fifteen minutes, apparently stronger than before.

Despair now became overwhelming. Whereas before one could get some protection by staying in the downwind rooms of the house, with the winds reversed, the area of the house which was now downwind was in most instances nothing but glass shards and perhaps a few timbers; there was almost no place to hide. Walls and furniture were gone. In many cases only the floor boards remained. Some families elected to stay in what was left of the bathroom, some tried the storage area immediately below the floor of the house, while others who could get the car doors open sought protection there. Mattresses became the most valuable property that night. They were about the only moveable source of protection from flying debris.

Cut feet were common. In the tropics substantial shoes are seldom worn and for most persons the recognition of need for such shoes came too late to do anything about it.

Hysteria was rare during that Christmas Eve night. Children, even young children, were incredibly composed and quiet except when seriously injured. There was worry about what was happening to pets, but most thoughts were centered on sheer physical survival. The hours dragged by. It was after 6 A.M. before one could be sure that the winds were really subsiding.

Daylight brought more shock. The idea that the heavy damage was confined to the immediate neighborhood quickly gave way. As far as the eye could see there was almost total devastation. Every tree and bush was stripped bare, an unreal sight for those accustomed to the lush foliage of the tropics. Strips of corrugated steel roofing seemed to blanket the area like snow. In certain parts of Darwin there was scarcely a wall of any kind in sight. The whole skyline had changed. Darwin looked like a war-ravaged city. All the power lines were down along with many trees. Timbers, shattered wood and glass were everywhere. It was still raining off and on. There was total, stunned disbelief by everyone at what they saw.

First actions included efforts to make the family and any "cyclone guests" more comfortable. There wasn't much with which to do it. What wasn't blown away was damaged. Everything was soaking wet. Thereafter, the men started looking through what was remaining of surrounding homes to rescue trapped or injured neighbors. Given the extent of damage and the long hours of flying debris, the number of dead and injured was incredibly low. When it is noted that driveways and streets were so filled with debris that in most sections of the city it was nearly impossible to drive anywhere to get medical attention, the figures seem even more astounding. The estimated dead, including the missing, numbered 50, and 1,012 were reported injured. The losses on a per family basis along with the number of families affected are shown in Figure 2.*

---

*A comparison of the losses experienced in Tracy is made with those of Rapid City (1972), Xenia (1974) and two "coming San Francisco earthquakes" (Richter 6.0 and 8.3). See enclosure 3.

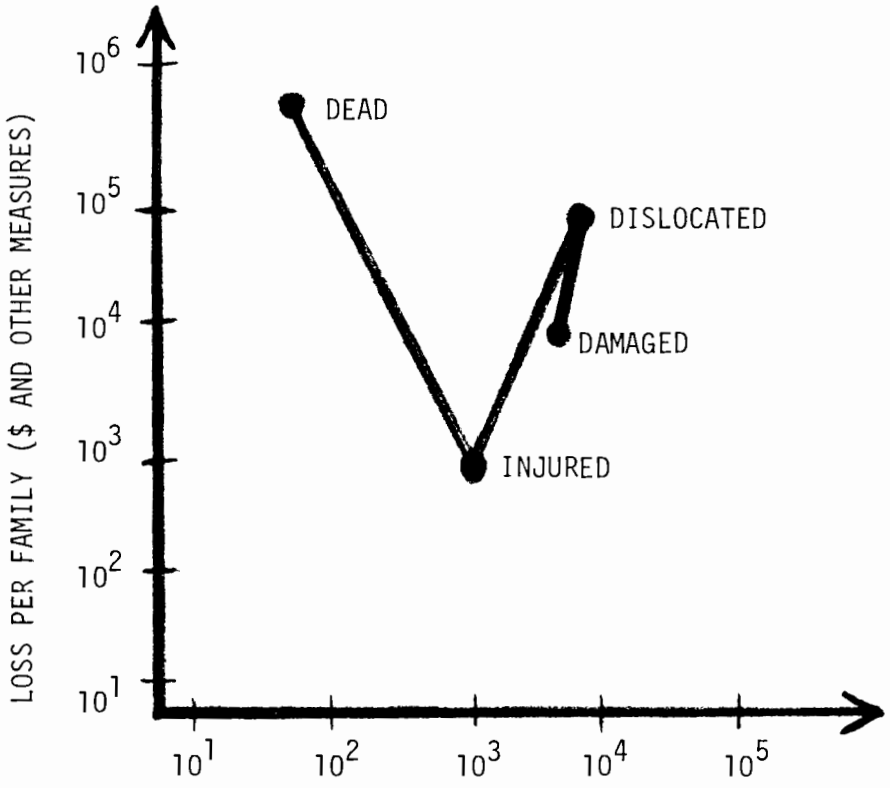


FIGURE 2

CASCADE OF DISASTER EFFECTS: CYCLONE TRACY

The same conditions that made medical care problematic also reduced drastically any tendencies for convergence. While some respondents whose homes suffered only minor damage did try to drive around to see the devastation and offer help if needed, apparently the debris littered streets and downed power lines combined with the fact that most persons had their own pressing damage problems, eliminated the possibility of convergence becoming a problem.

As Christmas morning wore on, food and water started getting attention. It was quickly recognized that without electricity for refrigeration all uncanned food would spoil within hours in the tropical heat. Quantity of food was not a problem in most cases since everyone had stored up for Christmas feasting. Most refrigerators were still intact and those who had little left to eat were invited to join neighbors who had more. Some families ate "cold" food in midmorning but many managed to fire up their outdoor barbecues or use camping stoves to cook "Christmas dinner". Wines and soft drinks were available in most instances. In some cases rain water was collected for drinking.

While some persons, mainly women, cried periodically throughout the morning, the overriding attitude was one of "It's over now. We may as well get to work and try to clean things up." In only a few instances that day did families just walk away from their homes with the intent of never coming back. There was clear evidence of resiliency even amidst the continuing shock. People were indeed stunned but for the most part they were neither passive nor apathetic.

THE DECISION TO EVACUATE

On Christmas morning key Northern Territory officials and local leaders gathered at the Northern Territory central police station. The Emergency Operations Center was under three feet of water and totally unuseable. They found the police force of nearly 200 largely intact. The city did not have a comprehensive disaster plan but had recently developed an outline of a plan which was built around a system of ten major committees. It had been adopted just ten days before Christmas.

There were no communications within Darwin and only limited relay communication from a ship in the harbor to the outside for several days.

Within the city limited communications were re-established between police cars and the central base station within a few hours after the disaster by use of a small generator. All other communications had to be by runner or courier. Reserve signal equipment stored at the army base was not used for the first three or four days because specific need for it had not been made known. Before the disaster, monitoring procedures had not been established with other areas outside Darwin.

Given the remoteness of Darwin and the fact that water, electricity, communications, and homes were extensively damaged, officials saw the potential of severe health problems. The principal threat seemed to be the non-functioning sanitary sewer system. Therefore, it was decided before noon of Christmas day that the population would have to be thinned. Assignments were made to the various departments. The Fire Brigade was given search and rescue responsibility. The Education Department, Northern Territory, was given responsibility for evacuation of people;

the Transportation Department was to furnish buses and courier service.

General Stretten, the newly appointed Director General of Australia's National Disasters Organization,* arrived in Darwin at 10:30 P.M., December 25. At 8:30 A.M. Thursday, December 26 he dispatched his first report (see copy of message, p. 13) via the motor vessel "Nyarda" to Sydney radio at which point it was relayed to Canberra, the capital.

With this message the resources of the Commonwealth were officially committed to the evacuation of most of Darwin's 47,000 population. He then called the first of what was to be twice daily meetings to exchange information and coordinate efforts.

But it would be misleading to say that General Stretton operated as a field commander in the military. He coordinated and made many critical decisions which required prompt action. But it is generally agreed that during those early days Darwin was run by group leaders, each with a primary area of responsibility.

Early talk of moving the city to a less vulnerable location faded about two weeks after the cyclone struck Darwin.

One view repeatedly voiced was that the Christmas holidays were a blessing in disguise for the Darwin disaster victims. Traditionally, almost all government workers are off work between Christmas and New Years. Thus, it was thought, quick decisions were made because most

---

*The National Disasters Organization was established on July 1, 1974. Its first Director General was appointed in early November of the same year. A national disaster response plan had been finalized in mid-December, 1974. The NDO was operational in Canberra and thereby provided the mechanism for channeling requests for support and assistance to Darwin. The Director General had direct access to top military officials but his position was not part of the military chain of command.

Message:

TO MOC
FROM SYDNEY RADIO 260043GMT

DARWIN VIA SYDNEY RADIO 340 26th 0030GMT

NEOC
THROUGH MARINE CENTRE
CANBERRA

FM MAJOR GENERAL STRETTON
ONE. DISORGANISATION HERE STILL DESPITE GREATEST EFFORTS BY ALL LOCAL AUTHORITIES. COORD CONFERENCE 0900. OUTSIDE PMG COMMS UNRELIABLE AND LIMITED.
TWO. NO LOCAL COMMS EXCEPT POLICE RADIO CARS AND LIMITED SERVICES CAPABILITY. REQUEST SIX PRC77 SETS AND OPS REQUIRED. SEWERAGE BROKEN DOWN POWER OUT AND DIFFICULTIES WITH WATER SUPPLIES.
THREE. CONSIDER LARGE SCALE THINNING OUT OF POPULATION NECESSARY. POSSIBLY 10000 PEOPLE REPEAT TEN THOUSAND NO COMMS WITH CIVILIAN POPULATION UNTIL ABC OPENS HOPEFULLY TODAY. DIFFICULT TO CONFIRM NUMBERS BUT DR PATTERSON HAS APPROVED FREE AIR MOVEMENT. WILL DISCUSS WITH A/PM TODAY. CONFIRM PROBABILITY OF RECEPTION CAMPS FOR THOSE PEOPLE WHO HAVE NO RELATIVES OUTSIDE DARWIN.
FOUR. LATEST CASUALTIES 40 DEAD 112 INJURED ADMITTED TO HOSPITAL ON 25 DEC. BUT CASCVAC 4 AM TODAY AND TAA FRIENDSHIP ETD 1000 HRS FOR BRISBANE WILL BRING MORE SITTING CASES. SURGICAL TEAM PLUS RAAF DRS AND LOCAL RESCOURCES AVAILABLE TO COPE AND CONFIRM SURGICAL TEAM IN SYDNEY CAN BE STOOD DOWN.
FIVE. TRYING TO ESTABLISH EVACUATION AREA AT RAAF BASE BUT UHLIKELY ANY MAJOR FLYOUT WOULD BEGIN UNTIL 27 DEC BECAUSE OF LACK OF COMMS WITH PUBLIC. WE WILL BACKLOAD AS MANY AS POSSIBLE TODAY.
SIX. PLEASE ADVISE CAPACITY OF MELBOURNE FOR EVACUATION OF CIVILIANS.
SEVEN. I PROPOSE TO STAY HERE UNTIL I AM SATISFIED A LOCAL ORGANISATION IS SET UP. THIS WILL TAKE AT LEAST ANOTHER 48 HOURS YOU WILL BE AWARE OF PERSONAL DIRECTION OF ACTING PRIME MINISTER THAT I SPEAK WITH AUTHORITY OF AUSTRALIAN GOVERNMENT ON ALL OPERATIONAL MATTERS.

STOPPRESS APPRECIATE 12 GENERATORS AND LIGHTING EQUIPMENT TO BE LOADED ON HMAS STALWART FOR LIGHTING OF REFUGEE CENTRES NOW LOCATED IN FOUR SCHOOLS.

ENDS

of the potentially squabbling bureaucrats were not around to slow down the decision making and enacting processes. The skeleton staffs in the capitol and at the state level were able to act with dispatch.

Parliament acted promptly also. Three days after the holocaust new disaster legislation was written and two days later it had passed Parliament and become law!

LEGAL ASPECTS OF THE EVACUATION

Unlike the president of the United States, the Prime Minister of Australia has limited powers with respect to disaster assistance. Therefore, Natural Disasters Organization's Major General Director Alan Stretton operated by persuasion and implied powers. According to Stretton, the Prime Minister gave him nonexistent legal authority to take total command of local operations in Darwin. He acted with vigor. On occasion he even countermanded the orders of cabinet members. The Australian states are wary and sensitive to any use of direction by the Commonwealth. The cabinet met to authorize certain actions such as paying air fare for the return to, as well as the evacuation of, Darwin. Money and legal hitches apparently were not the thought of either political party in supporting the evacuation effort; they responded from a basis of compassion and humanitarian concern. General Stretton felt he had two jobs, one of directing operations in Darwin and the other in getting his deputy in Canberra to secure supplies and airplanes. The Natural Disasters Organization was active from December 25 until it withdrew from Darwin operations on December 31 and turned all responsibility back to normal administration.

As there was no legal basis for many of the actions taken during the immediate emergency period, the Legislative Assembly, Northern Territory, passed an ordinance providing for emergency measures taken from December 25 to three months past enactment. In the opinion of some Legislative Assembly personnel, Northern Territory officials were doing many things well beyond the legal authority established by the enacted

ordinance. Funding arrangements or reimbursements for those activities outside Darwin, such as those of the reception cities, have yet to be fully worked out. As the Government of Australia had no authority to order or handle the evacuation, states were requested to set up a program. The Natural Disasters Organization asked the Australian Capital Territory policy to make the necessary inquiries of the various state police. All but one state did respond. In the one state that did not, a voluntary committee was established.

EVACUATION AND ITS CONSEQUENCES FOR THE FAMILIES

Most persons could not be sure that the entire city had been hit, although they strongly suspected that. With the power out there was no radio, TV or telephone communication. As Christmas morning wore on, the police made an effort to get the word around that most of the schools were being used for temporary shelters. Those whose dwellings were no longer livable gradually made their way to the closest school. Within the first 24 hours the conditions there became less than minimally acceptable. Indeed, for some families the conditions were simply not tolerable at all; they chose to return to their battered homes rather than to live at the school.

There was plenty of food in Darwin stores and warehouses. However, most persons had little or no money available and all the banks were closed. Local officials felt that it was important for families who wished to do so to cook their own meals. Schools in Darwin did not have facilities for mass feeding. Many families had access to outdoor barbecues or camping stoves. It was thought that cooking meals would provide a needed diversion. For this and probably other reasons it was decided to make free food available from the supermarkets for anyone who wished it. The head of the local food committee, himself a leading food wholesaler in Darwin, put into effect the simplest of all possible arrangements--have the supermarkets open up their doors and let the "customers" cart away as much food as they wished. This went on for more than three weeks, until January 20, 1975. There were only a few instances of reported hoarding of the free food. The government paid

the store owners for the difference between predisaster and post January 20 inventory figures. Record-keeping costs were thus almost zero. Some free clothing was given away on the same basis.

By Christmas afternoon, talk of large-scale evacuation was heard. Specific information regarding any organized plan and procedures for evacuation did not come to people in the schools until a radio announcement just before noon on December 26, 1974. (Radio broadcasts to the public were interrupted for 34 hours by the storm.) Others got the first official word when it was announced within the school, that everyone wanting to evacuate should sign up promptly. It was announced very early that there would be priority categories for early evacuation: pregnant women, small children, the injured and elderly would go first.

Each adult was asked to indicate to which of several large cities in Australia he or she wished to be flown. They were told to listen to the radio and to watch for lists to be posted within each school for their name and departure time.

The first evacuation flight was a Quantas 707 which departed Darwin at 7 P.M. on December 26, just 36 hours after Tracy's winds had subsided. Also on the 26th, officials set up a reentry permit system reportedly without any legal authority to do so.

Because there was no electronic communication until the fourth, when army communication equipment became available, couriers went to the transportation dispatch office and to the various schools with messages concerning evacuee priority and destination. Buses then proceeded to the marshalling areas, loading evacuees and transporting them to the airport. This proved to be ineffective and gave way to a procedure in which buses were loaded

by priority category and then sent to the airport.

The disaster plan had not included a fuel committee. One was quickly established. Many of those who drove out apparently did so because they were unwilling to part with their pets. Pets were not allowed on the aircraft and any roaming cat or dog was to be shot. Others drove because they could take more luggage with them. The limit for those flying was 50 pounds per person. An estimated 10,000 persons drove out of Darwin the first week. Late on December 26 road blocks were established to get a tally of those departing.

Those who chose to drive to Brisbane from Darwin were checked through Mount Isa, which is the first town of significance in the northwest corner of Queensland, some 1,000 miles from Darwin.* All cars were inspected for roadworthiness, and repairs, including the replacement of worn tires, were authorized up to the cost of a first class air ticket from Darwin to Brisbane. Prior to leaving Darwin, drivers could secure petrol tickets for procuring free gasoline along the way. However, unexpectedly some of the country service stations refused to honor the tickets indicating a reluctance to carry government credit. In addition, not all police stations were aware of the petrol ticket scheme, causing some inconvenience for those people stranded with little money and no gasoline and the police having no authority to do anything about it.

---

*From Mount Isa to Brisbane the evacuees were given the choice of 1) continuing the road journey, 2) loading their auto on a train and making the trip by train, or 3) loading their car onto a train and flying on to Brisbane.

At Mount Isa, evacuees were given cash benefits of over $100,000. Each adult received $62, with smaller amounts for children. There was no means test used. A similar operation took place at Alice Springs, midway by road between Darwin and Adelaide. Those driving through Alice Springs reported no difficulties with the roads and outstanding hospitality and support all along the way.

The initial concept for an evacuation included the idea that each person would be flown directly to the city of her or his preference from the following list: Brisbane, Sydney, Melbourne, Adelaide, and Perth. The first evacuation flights by large aircraft departed Darwin at 7 P.M. on December 26th. By December 27th it became obvious that city preference had to give way in face of the overwhelming need to move people out of Darwin fast. Too much delay occurred when attempting to match city preference with seating availability on the planes. Thereafter other criteria were used to determine where a plane load of evacuees leaving Darwin would land first.

There was a great deal of discomfort and even suffering those first few days. Moethers with small children had an especially difficult time. Heroic as the efforts were to develop and use humane and effective evacuation procedures, the situations that developed were exceptionally hard on the women and children who evacuated during the first two days of the airlift. Although the living conditions at most schools were grim, what transpired after leaving the school was even more so. People would be awakened in the middle of the night and would be put on buses only to sit in the bus for several hours. On a number of occasions evacuees had

to wait up to four hours in a hot bus. At other times women and children were told to sit on the concrete at the airport until they could board a plane. Several hours in the hot sun was very painful, especially after what they had been through since Christmas eve. Some mothers reported having to sleep on the concrete all night with their children while waiting at the airport. At certain times there apparently was no drinking water available at the airport for the evacuees for as long as six hours. Baby diapers (napkins) were in short supply at various times.

In a few instances, women with small children refused or were reluctant to evacuate. Officials used persuasive arguments and, in at least one case, threatened the use of physical force to get a mother and her children on the airport bus. In most cases, there was reported agreement between husband and wife regarding evacuation. The almost total lack of electricity, water and sanitary facilities made the decision easy for most persons. Nevertheless, there was one point in time when the number of seats available on incoming aircraft (7,000) far exceeded the number of persons who had signed up for evacuation (800). Faced with this situation, Major General Stretton came up with what proved to be an effective strategy. He requested that the Commonwealth government agree to pay for return air fare for anyone who evacuated Darwin. Upon getting assurance on that point, he went on radio and sent out word to the shelters that return air fare was guaranteed for anyone who would leave now, but that he could not be certain that the offer would apply later. Within a matter of hours there were far more people at the airport awaiting evacuation than there were available seats on aircraft! In the end, 8,200 persons were evacuated by air that day.

On occasion, children got separated from their mothers and short emotional outbursts ensued. There were some efforts made to beat the system by persons in less than top priority categories for early evacuation. On the whole, however, scenes at the public shelters and at the airport were characterized most by patience, understanding and cooperation. There was no panic at any time and very little theft was reported. Indeed, a number of inmates of a prison farm outside of Darwin escaped Christmas day, spent the next week in volunteer clean up work, and subsequently received full pardons.

There were two kinds of rumors which may or may not have been encouraged by officials as a technique to get people to evacuate. One rumor was that the cyclone was coming back. That one persisted for two to three days. The other rumor, reportedly repeated by some officials, was that typhoid fever had broken out in some of the shelters. This rumor did seem to have significant impact on those reluctant to evacuate.

And what of the flights? Most evacuees flew on the planes of Ansett, Trans-Australia Airlines, and Qantas, although the Australian and U.S. military also provided aircraft.* All members of civilian flight crews were volunteers. The flights, especially during the first three days of the airlift, were overcrowded. Perhaps the extreme case was that of a Qantas 747 flight which took off for Sydney with a total of 694 passengers and crew, with a seating configuration designed for approximately 400.

---

*U.S. A.I.D. budgeted $660,000 for Darwin disaster assistance, but only $224,000 was used. That was for the cost of the use of the aircraft which were brought from California.

All told, more than 23,000 were flown out by December 31, 1974. The feat was comparable to evacuating that number of persons from a disaster-stricken San Francisco to cities such as New Orleans and Minneapolis.

Even though the flights were longer than 3 1/2 hours, in most cases only snacks and beverages were served to the passengers. There were no significant behavioral problems of any kind on the flights despite the overcrowding and exhaustion of the passengers.

Some passengers had relatives waiting for them at the first stop. Others were processed at the first airport and, after a wait of from three to twelve hours, were put on another flight to a second and perhaps even a third city before they reached their final destination. Selection of final destination was based on a variety of reasons: 1) location of family (parents, sisters, brothers); 2) familiarity as a result of prior residence there; 3) climate; 4) anticipated similarity between school programs in Darwin and schools in final destination. The vast majority did have a preference and so far as we know all eventually got to their preferred city, even though it may have been as much as 24 hours from departure at Darwin airport until arrival at final destination for those who evacuated by air. Those who drove took from four days to two weeks to reach their destination.

As indicated earlier, the states were asked by the Commonwealth government to receive the evacuees and provide assistance. The views of our respondents on the adequacy of reception and assistance are mixed. Their reports range from accounts of little assistance and condescending treatment, to stories of well-planned, rapid and personalized attention. Social class and ethnic differences seem to have played a part in the

negative feelings that did exist. On the whole, however, evacuees were grateful for and pleased with the assistance provided them.

It should be noted that the receiving cities had very little time to get geared up for the massive influx of evacuees. Further, those operating the reception efforts seldom knew from hour to hour when a flight would be arriving, with how many passengers, what their immediate needs might be and their ultimate destinations. For example, in Brisbane at one point an estimated 2,000 evacuees and workers were in the airport during one hour when four planes arrived.

In Brisbane, the Social Services Department felt that they may have been stampeded into emergency pay when they realized that the Darwin evacuees had little or no money. Since cash benefits as such had never been needed in previous disasters, there was a problem of getting large sums of cash from banks. Social Services obtained $100,000 in cash from the Commonwealth Bank (comparable to Federal Reserve) on Friday afternoon, December 27, just before the automatic locks set for the weekend. The money was put in the trunk of the Social Services Director's car. A sum of $105,000 additional cash was needed Sunday, so arrangements were made with the banks to secure money from betting parlors. Money was placed on a table in the McLachlon Street Center and was handed to evacuees as they were processed. Evacuees signed for the money as they received it.

In Brisbane, the principal responsibilities were allocated as follows:

Registration - Emergency Services Organization (state)

Clothing (from donated stocks) - Red Cross

First Aid - Red Cross

Food Service - Food provided by Lions Club, facility serviced by Salvation Army

Tracing Service - Red Cross

Cash Disbursement - Commonwealth Department of Social Services

Transportation - Commonwealth Car Pool

A major problem for officials and volunteers in receiving cities centered on the extreme difficulty of keeping track of evacuees in order to assist them further if there were needs. The vast majority of evacuees did not live in government owned hostels or military barracks for more than a few days, if at all. Most persons were processed rapidly and during those early hectic days little attention was given to setting up procedures for keeping records of where evacuees would be living, especially after their first stay, e.g., a mother and her two children might have been placed in one of the many thousands of private homes in which space was offered.* Later the mother may have located friends or relatives who took her in. There would be no record in any of the assisting agencies that the move had taken place. Furthermore, once the evacuees were located somewhere in the receiving city and the main processing effort was completed, evacuees seeking assistance or information about the possibility of returning to Darwin had no readily identifiable point of contact.

---

*It is estimated that only one in six wanted special lodging. Most went to relatives or friends. In every receiving city there were far more spaces available than were needed. These included space in private homes, hostels or other government civil facilities, and, of course, military barracks. It is estimated that 15-20,000 persons used government facilities at or near the airports, but less than 10,000 used hostels or similar facilities for more than a day or two.

Finally, several of the receiving cities did set up such contact points or centers under quasi-private auspices. In some cases newspaper advertisements were used in an effort to reach Darwin evacuees who might need information or assistance. The problem was confounded for those who left Darwin by land.

There was a related challenge for the government. All Commonwealth civil service personnel were to continue getting paid regardless of location and status of employment. Getting the pay checks to the scattered evacuees was often difficult because their locations were unknown. Newspaper advertisements in the major cities was a method used to get in contact with government employees.

AN ACCOUNT OF THE COSTS AND WHO WILL BEAR THEM

The breakdown of disaster costs provided in Figure 3 indicates the relatively minor significance of the evacuation costs when compared to the destruction of private housing. Forty-two percent of the total costs of the disaster, estimated to be $500 million, is attributable to destruction of dwellings. Another 10% can be linked to housing damage. The total evacuation cost contributed less than 4% to the sum of all losses and costs experienced in the wake of Cyclone Tracy.

The physical destruction to dwellings in Darwin exceeded by five fold the amount of homes lost in either the Rapid City or Xenia disasters of 1972 and 1974 respectively. In fact, in terms of sheer destructiveness, the storm produced almost as much total loss (the number of homes that will have to be written off) as is predicted for the coming San Francisco earthquake, Richter 8*. This does not mean, however, that the total costs associated with the Darwin event will even come close to the total costs of the expected San Francisco quake. When all is counted, the $500 million attributable to Tracy will amount to only 3% of all San Francisco's losses. Why the difference? The difference lies in the fact that earthquakes of large magnitude affect a much wider area, ranging into the hundreds of square miles, than that of most tropical cyclones. So, even though 8,000 homes were demolished by Cyclone Tracy and 12,000 are forecasted

---

*See Enclosure 3 for graphical comparison of these events.

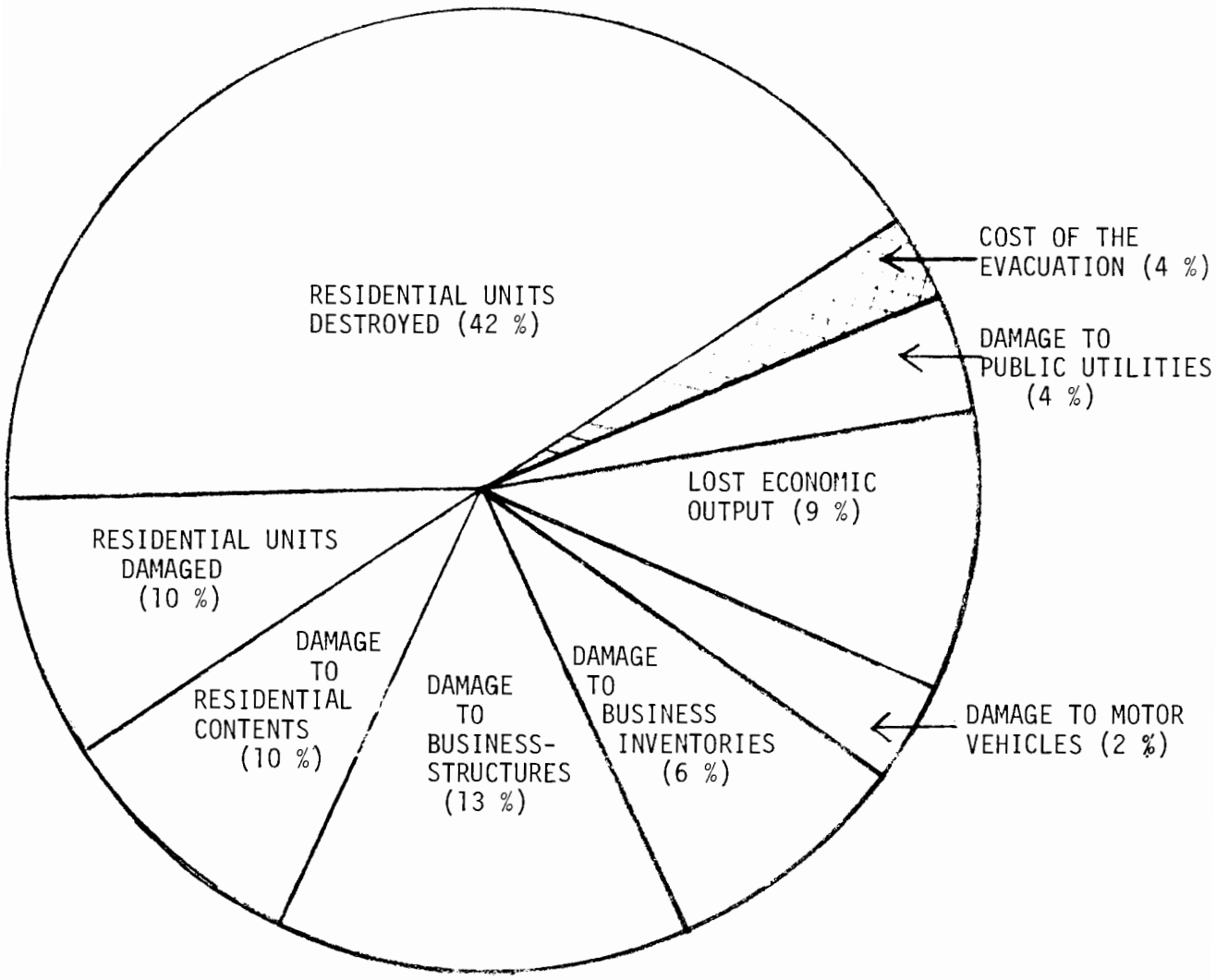


FIGURE 3

BREAKDOWN OF DISASTER COSTS

to meet a similar fate in San Francisco, nearly one million more will be damaged in the earthquake. This damage in aggregate will exceed by far the losses resulting from dwellings totally destroyed.

Figures 4 and 5 graphically suggest the force of Cyclone Tracy's winds.* Figure 4 shows the percentage of dwellings sustaining damage exceeding 80% of the dwelling's value. Figure 5 illustrates the extent to which dwellings sustained damage exceeding 60% of their value. As these figures show, even given the most conservative definition of destruction (80% of the value destroyed), the number of areas where extensive damage was recorded is numerous.

At first blush the lost economic output, estimated to have been less than 9% of total disaster costs, is relatively minor when compared with estimates made for other disasters.** A severe economic contraction is unlikely to occur in Darwin due to its economic makeup. There are two activities which account for 89% of Darwin's work force; government service, 45% and wholesale/retail trade, 44%. The remaining 11% of Darwin's work force is spread among activities such as livestock and agriculture (1.5%), mining (1.8%) and minor manufacturing (5.6%).***

---

*A layout of the city and description of the wind field is provided in Enclosure 2.

**For example, Cochrane, 1974, estimated the indirect losses ensuing from a repeat of the 1906 San Francisco Earthquake to equal nearly one-half of the total loss.

***There is a striking similarity between Darwin's economy and thatof Alaska just prior to the Great Earthquake in 1964. At that time 51% of Alaska's work force was comprised of government employees.

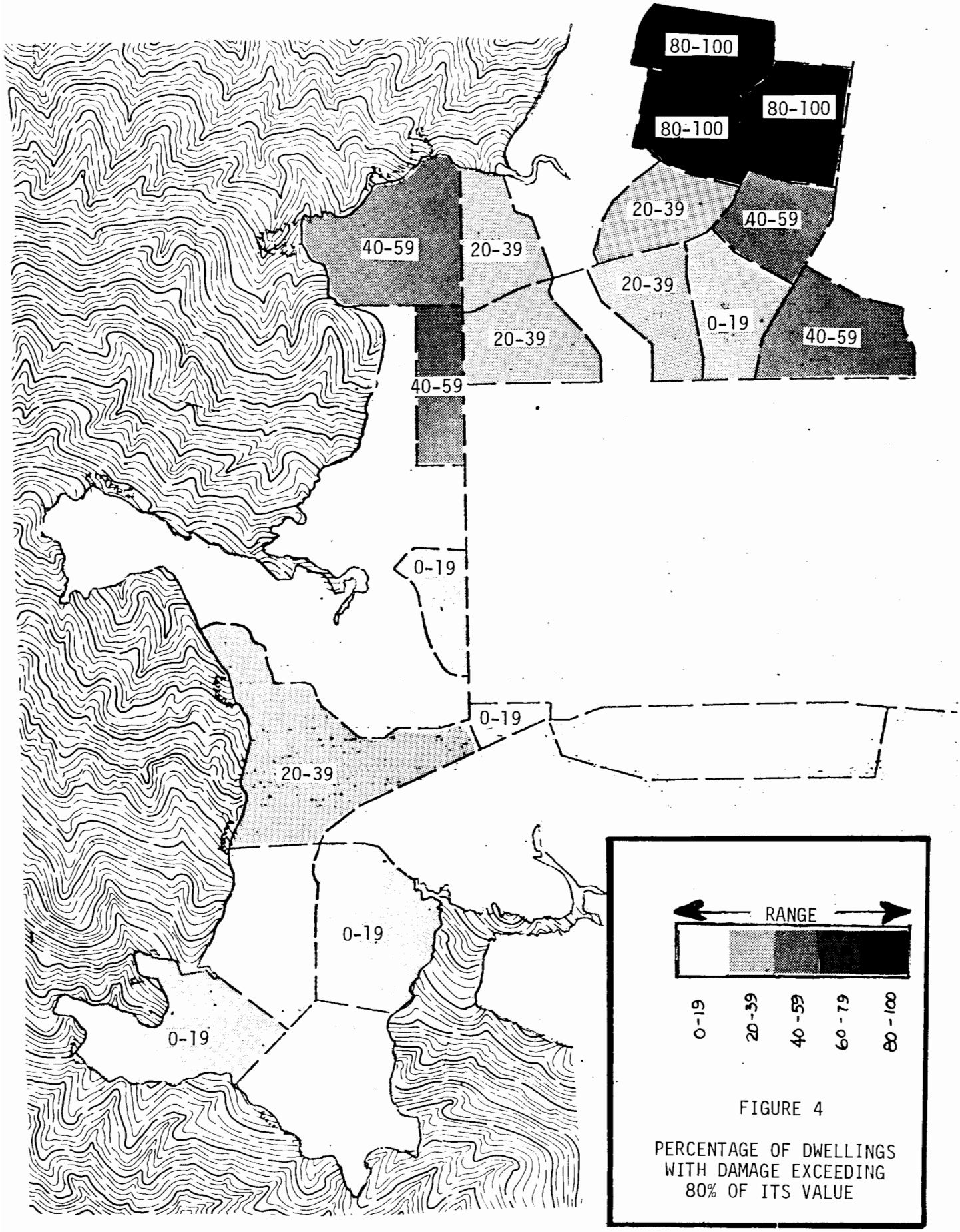


FIGURE 4

PERCENTAGE OF DWELLINGS WITH DAMAGE EXCEEDING 80% OF ITS VALUE

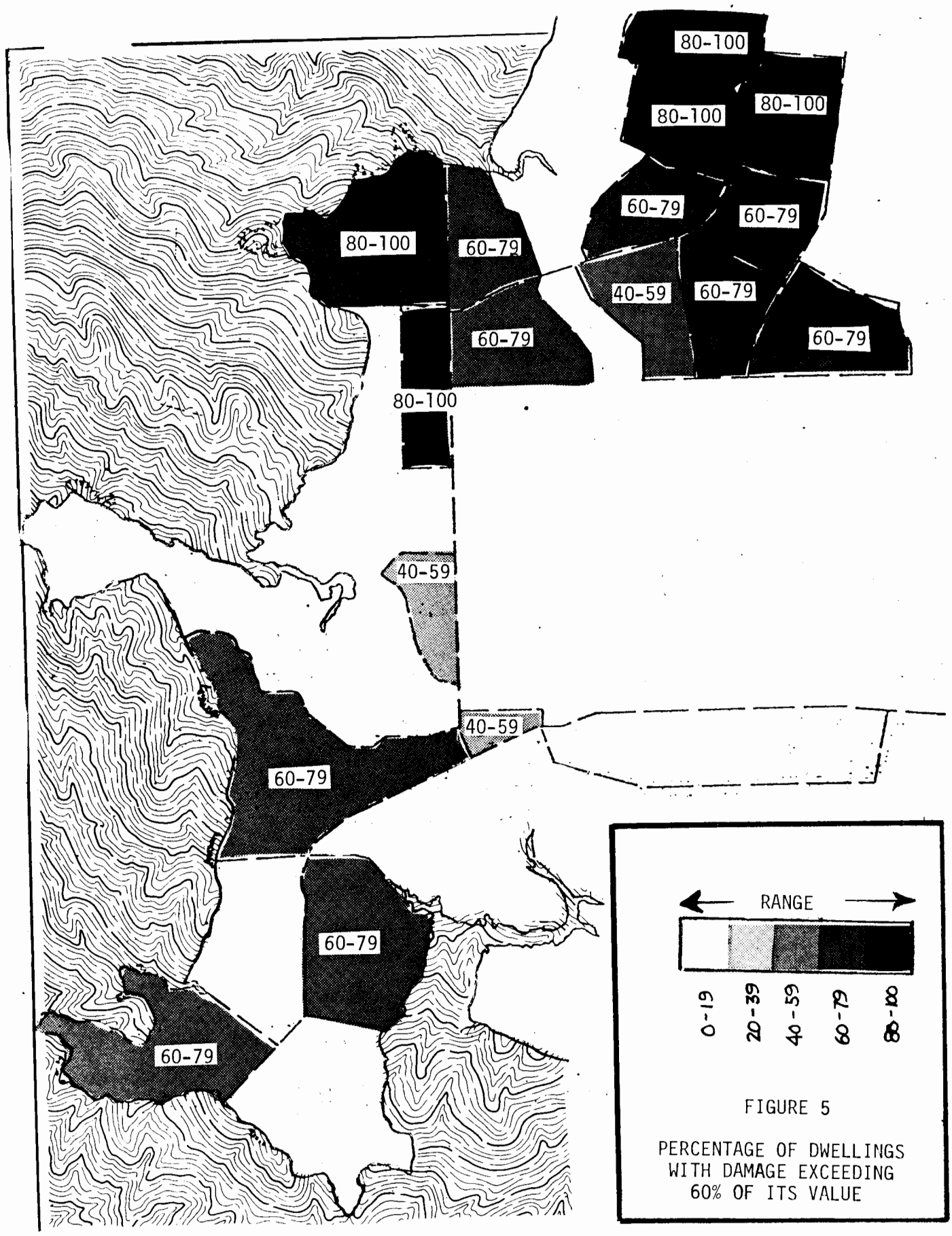


FIGURE 5

PERCENTAGE OF DWELLINGS WITH DAMAGE EXCEEDING 60% OF ITS VALUE

This absence of large-scale manufacturing activity has tended to insulate Darwin's economy from the destruction of the storm. Although more than one-half of Darwin's business establishments were destroyed, the remaining shops and new ones which are coming into the region have been able to accommodate, with some strain, any slack in capacity. The prime factor which will influence how quickly Darwin's economy recovers will be the decisions made in Canberra as to the location of various Northern Territory functions. Currently all but 1,500 of the original 7,000 Commonwealth employees have returned to Darwin.*

The return of Commonwealth employment has created, along with the inflow of insurance money, a floor upon which the economy, and consequently the population, will grow. Reviewing Darwin's recent history (Table 1) shows how closely population and Commonwealth employment is linked.

The stability of the ratio total population to Commonwealth employment (column 4) indicates how pervasive the federal influence on Darwin's past and future is. Given that current federal work force is approximately 5,500, the local economy could absorb about 36,000 people, or 6,000 more than the March 25, 1975 census indicated as already living in Darwin. The massive inflow of construction funds from both insurance settlements and government housing programs would swell the economic base even further. The availability of jobs does not appear to be a hindrance to the resettlement of the evacuees.

---

*1,500 were transferred to Brisbane where office space could be obtained.

TABLE 1

Commonwealth Employment
and Population

Year	Population of Greater Darwin	Darwin Based Public Service	Ratio of Total Population to Public Service Employment
1966	21,671	3,638	5.91
1967	23,350	3,697	6.32
1968	26,270	4,248	6.18
1969	29,340	4,538	6.47
1970	32,943	4,998	6.59
1971	37,060	5,562	6.66
1972	40,885	6,139	6.66
1973	42,843	6,513	6.58
1974	46,656	7,274	6.41

Who will ultimately shoulder the losses? How the $500 million in losses will ultimately be spread depends upon the amount of insurance in force at the time of the disaster as well as the level of government assistance provided the disaster victims.

Early estimate of insurance coverage indicated that most disaster victims were grossly underinsured (see Table 2).

TABLE 2

Amount of Insurance
Coverage by Type of Loss

Nature of the Loss	Percent Insured
Business Premises	60
Business Contents and Stock	40
Dwellings	70
Dwelling Contents	20
Motor Vehicles	45
Health	60

(Data obtained from the Australian Department of Repatriation and Compensation)

If it weren't for the availability of government assistance, much of this uninsured loss would have been borne by the disaster victim. It was in response to this potential that the Commonwealth government on March 5, 1975, introduced legislation which would provide a grant covering 50% of the uninsured loss.

> The Minister for Repatriation and Compensation, Senator John Wheeldon, today released details of the Government Scheme to provide approximately $58 million compensation to victims of Cyclone Tracy, which struck the city of Darwin on Christmas Day, 1974. Legislation will be introduced into the Parliament as soon as possible.
>
> The Government has decided to compensate private individuals and businesses to the extent of 50% of the uninsured property losses subject to certain ceilings, and to pay compensation in respect of deaths and injuries. Compensation will cover dwellings, furniture and fittings, personal possessions (including motor vehicles but excluding boats and aircraft), and business premises, stock and equipment, crops and livestock. The market value of properties on the 24th of December, 1974 will be used as the basis for calculating compensation.

> The maximum amount of compensation to be paid for each of the dwellings, business premises, business stock and equipment, crops and livestock is $25,000. A limit of $5,000 will apply to the amounts to be paid for uninsured loss or damage of furniture, fittings and personal possessions.
>
> As previously announced, compensation for deaths and injuries arising from the cyclone will be paid along the general lines of the National Compensation Bill, which is now before the Senate. Injury benefits will be paid fortnightly until rehabilitation is achieved, or in the case of permanent injury, until age 65. Benefits will be adjusted from time to time to take account of cost of living increases. (News Release, Department of Repatriation and Compensation, 3/5/75)

Given the insurance coverage shown in Table 2 and the provision for government relief, it was possible to allocate the $500 million in losses illustrated in Figure 3 to individuals, insurance companies and the Federal Government. The diagram in Figure 6 illustrates both the magnitude of the losses (the diameter of the circle) and the distribution of these losses (the location within the triangle). A quick glance at the diagram shows that the relatively small evacuation costs were absorbed almost entirely by the commonwealth government. Residential losses, which loom large when compared with all other categories of damage and expense, appear to be shared primarily between insurnace companies and the Federal Government. Loss of residential contents, shown above to be grossly underinsured, is shown here to be borne primarily by the victim and the government.

How did the public sector and utilities fare with the evacuation? In most American communities an evacuation of this magnitude would have virtually doomed the local government to an economic collapse. The property and sales tax base, the prime source of revenue for American communities, would have withered to such a degree that local expenditures

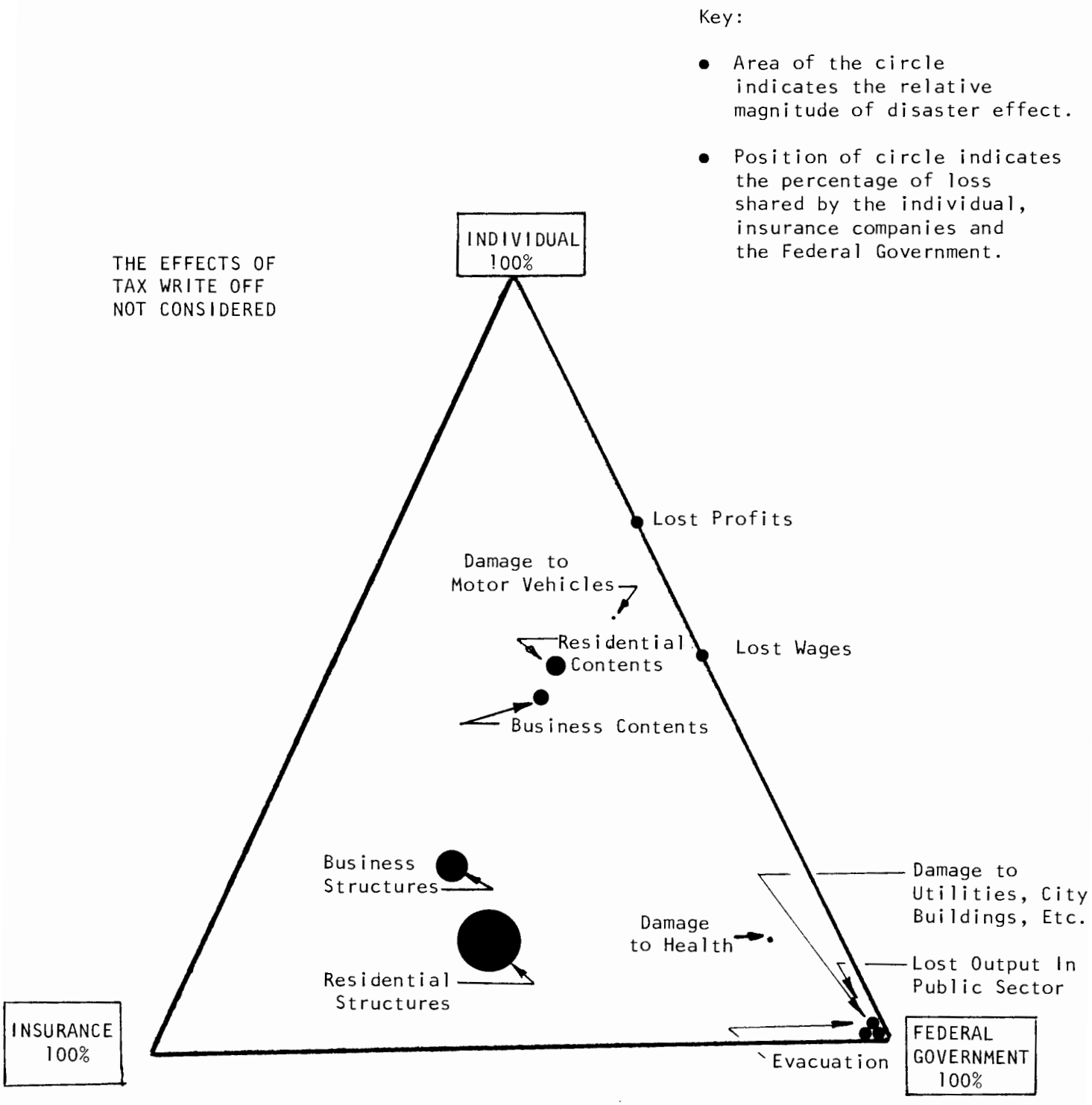


FIGURE 6

HOW THE LOSSES WILL BE SHARED

and services would have had to almost come to a halt. Such a scenario did not come to pass with the Darwin disaster because local government is a relatively insignificant force in the functioning of the community. It has a budget of approximately $2.5 million per year earmarked mostly for the maintenance of public recreational and cultural facilities. Its prime source of revenue is a property tax which is leveed on the unimproved value of private lots. Taxes seldom exceed $150 per year. The funding for schools, police protection and other municipal services including water and power is provided primarily through Commonwealth channels.

Since utilities were provided by the government, there was little problem with a continuation of service even though the service demanded after the disaster was only a fraction of the predisaster capacity.* A privately owned utility in the United States, particularly if it is a local enterprise, would be unable to continue operations over any extended period, given the magnitude of discrepancy between generating capacity and load such as that experienced by the publicly owned utilities of Darwin. Another advantage the public utilities of Darwin would have over their private counterparts in the United States was the fact that they could and did continue to operate without charging users. It turned out to be physically impossible to quickly repair or replace all damaged electrical meters. Consequently, it was decided to suspend billing to all users even though some meters were still functioning. In essence, those who returned to Darwin were granted free electrical service for a period of at least seven weeks.

---

*As of February 4, 1975, two months after the disaster, the load on the system was 16 MW although the generating capacity was 51 MW.

LIFE IN DARWIN NOW

The preceding sections dealt with the disaster itself, the decision to evacuate, the legality of that decision, and the consequences of the evacuation for the families. But the evacuation has another dimension which as yet has only been touched on--the effects of the evacuation on the well-being of those who remained behind. We pointed out early in the introduction that it is almost impossible to separate the closely knit influences of both the disaster and the fact that almost 36,000 people left the city. For example, as is shown in Figure 7, there were a number of inducements, previously described, to influence the population to leave, not the least significant being the fact that the disaster left almost everyone without a roof in the midst of the rainy season. Similarly, the lack of housing has (through the use of reentry permits) discouraged many from returning.

The analysis presented in this section is drawn from data gathered while in Darwin. It is organized around a series of questions which relate to the effect of the evacuation on reconstruction and its influence upon social or economic groups.

How did the destructiveness of the event affect the return of the evacuees?

Under what conditions are the returnees living?

How does dwelling destruction affect the number of women (hence families) returning?

How has the composition of the labor force changed since the disaster?

Can Darwin's businesses meet their needs without reliance upon outside sources of labor? How have businesses fared?

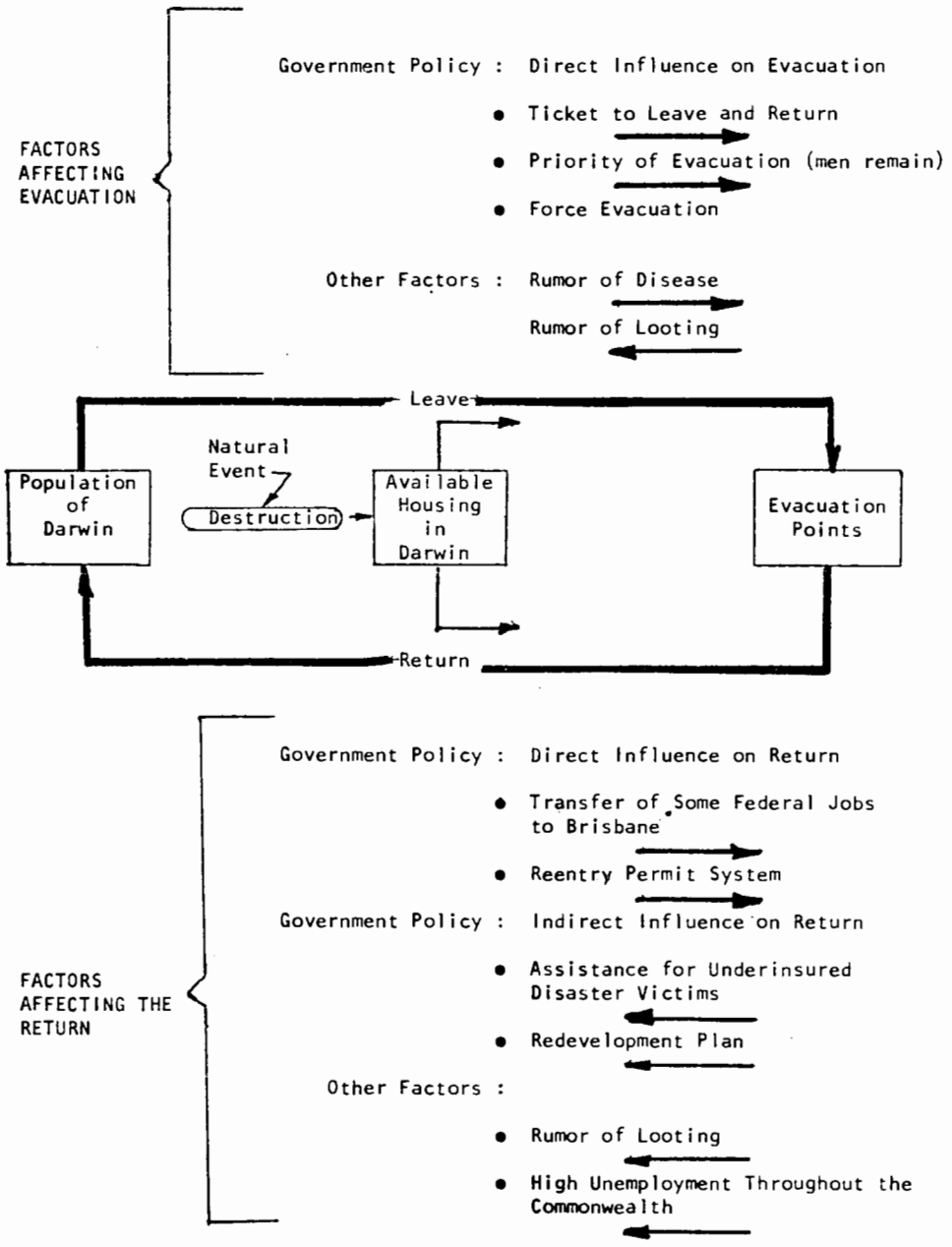


FIGURE 7

SYSTEM OF FORCES WHICH IS AFFECTING
DARWIN'S FUTURE POPULATION

How did the evacuation affect the age composition of Darwin's population? How has it changed since people began returning?

How quickly can the city be rebuilt?

How did the destructiveness of the event affect the return of the evacuees? Figure 8 shows that the availability of housing is in fact limiting the expansion of certain suburbs. Tiwi, Nakara, and Wanguri were dealt severe damage by Cyclone Tracy, witnessed by the fact that over 80% of the homes in these suburbs were totally destroyed. As one would expect, those same suburbs are shown in Figure 8 to have regained the smallest percentage of their predisaster population, less than 10% for both Wanguri and Tiwi. The two dashed lines illustrate the growth in population from the first Darwin census conducted just after the evacuation to the date of March 5. For certain of the less severely affected areas the growth in population has been dramatic. Ludmilla/ Narrows, which experienced only 10% destruction to its dwelling units, had, as of March 5, 1975, gained almost 90% of its predisaster population.

Under what conditions are the returnees living? Post-disaster Darwin presented an array of living standards ranging from a tarpaulin draped over what used to be the floor boards of the house to a relatively unaffected dwelling. Most houses sustained some water damage and many of the houses which appeared from the exterior to have weathered the storm in good fashion turned out upon more detailed inspection to have sustained extensive damage to their interiors.

Some feeling for the conditions under which many returnees are forced to cope can be obtained by extending the analysis shown in Figure 8 to include different levels of damage. Figure 8 was constructed based on

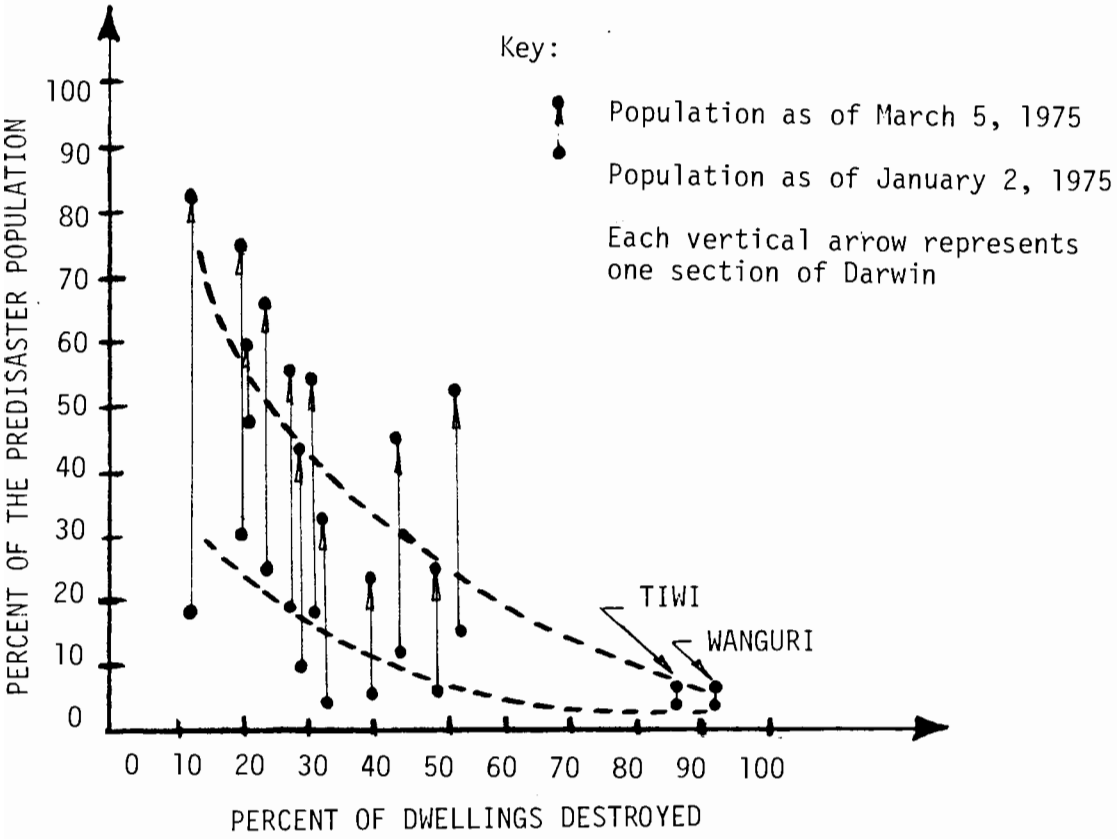


FIGURE 8

EFFECT OF DESTRUCTION ON POPULATION GROWTH

a rather restrictive definition of destruction--80% or more of a dwelling's value being destroyed. By any stretch of the imagination, a damage ratio of 80% represents a virtual disintegration of the structure. Under such circumstances it is not surprising that the population size has been effectively capped by the shortage of available lodging.

But, a tour of the city reveals that a considerable number of Darwin's population is living under spartan conditions, some barely being able to claim a roof. One would expect that a comparison of pre- and post-disaster housing capacity would indicate the immediate limits to which the population could expand. Figure 9 attempts to illustrate this problem. The first dashed line is identical to that shown in Figure 8 for the March 5, 1975 census. The second dashed line indicates that percentage of population returning as a percentage of the predisaster level, given that destruction is defined as a 60% or greater loss in a dwelling's value. The third line shows the same relationship if a 40% or greater loss in a dwelling's value. The third line shows the same relationship if a 40% or greater loss in value is equated with destruction. One would expect that if 10% of the dwelling's units were destroyed that a 10% reduction in the area's population would be required.* Similarly a 20% reduction in housing units would lead to a 20% decrease in population, and so on.

The data presented in Figure 9 suggests the nature of the living conditions alluded to above. The number of dwellings sustaining 60% or more damage appears to be the limiting factor in Darwin's growth (the percentage returning is just proportionate to the number of dwellings removed from usefulness, i.e., the number that have sustained 60% or more damage). However, a large number of individuals have opted to return even though

---

*Assuming that the population density remains the same.

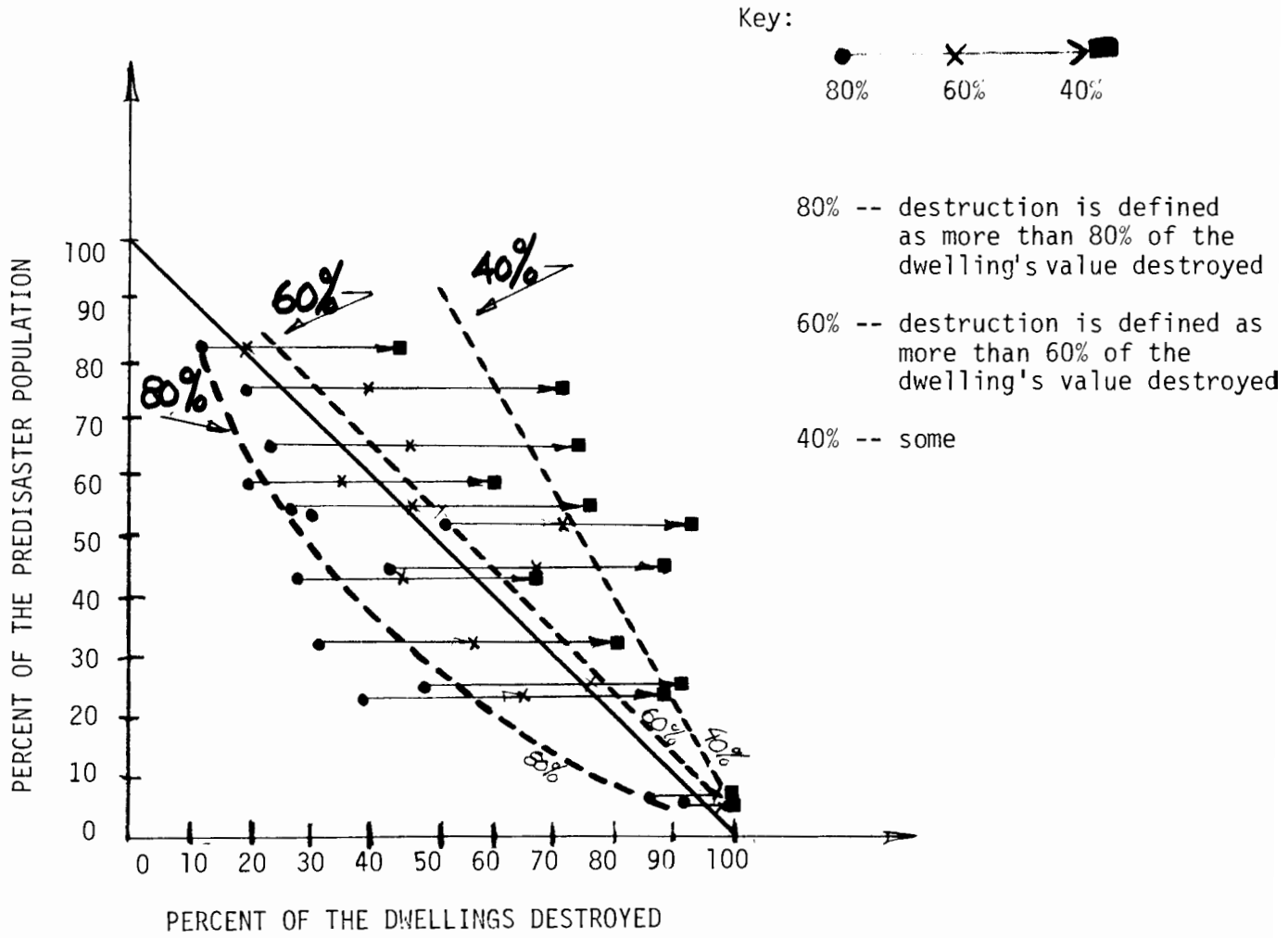


FIGURE 9

EFFECT OF DESTRUCTION ON POPULATION GROWTH
(different definitions of destruction)

their dwelling has sustained at least 40% damage. Although not considered total destruction in the strictest sense, damage even at this level is substantial and the hardships created far from minimal.

There were 10,000 telephone subscribers in Darwin before Christmas. Now (March, 1975) that number has dropped to 2,500 subscribers.

How does destruction affect the number of women (hence families) willing to return? Figure 10 shows that the number of females as a percentage of the total population appears to be insensitive to the degree of destruction present. The destruction shown ranges from as little as 10% in Ludmilla/Narrows to as much as 93% in Wanguri. It seemed likely that the number of families living in different sections of the city would be sensitive to the destruction, the more the destruction, the fewer the families. The evidence shown in Figure 10 does not appear to support this contention. Although on a percentage basis, males form a larger percentage of the population (average 64%) than the predisaster level (average 54%), this shift appears to be independent of the destruction present in the area.

How has the labor force change? Figure 11-A shows how the age distribution of the labor force has been altered by the disaster and subsequent evacuation. It appears that the most significant effect has been a reduction in the relative number of younger workers while those in the bracket 25-59 grew. One guess as to why such a shift in the ages of the work force came about is that the younger workers have less stake in the community and therefore may return less readily. It isn't unreasonable to expect that they are also the residents who have spent the least time in the community. However, a more detailed investigation

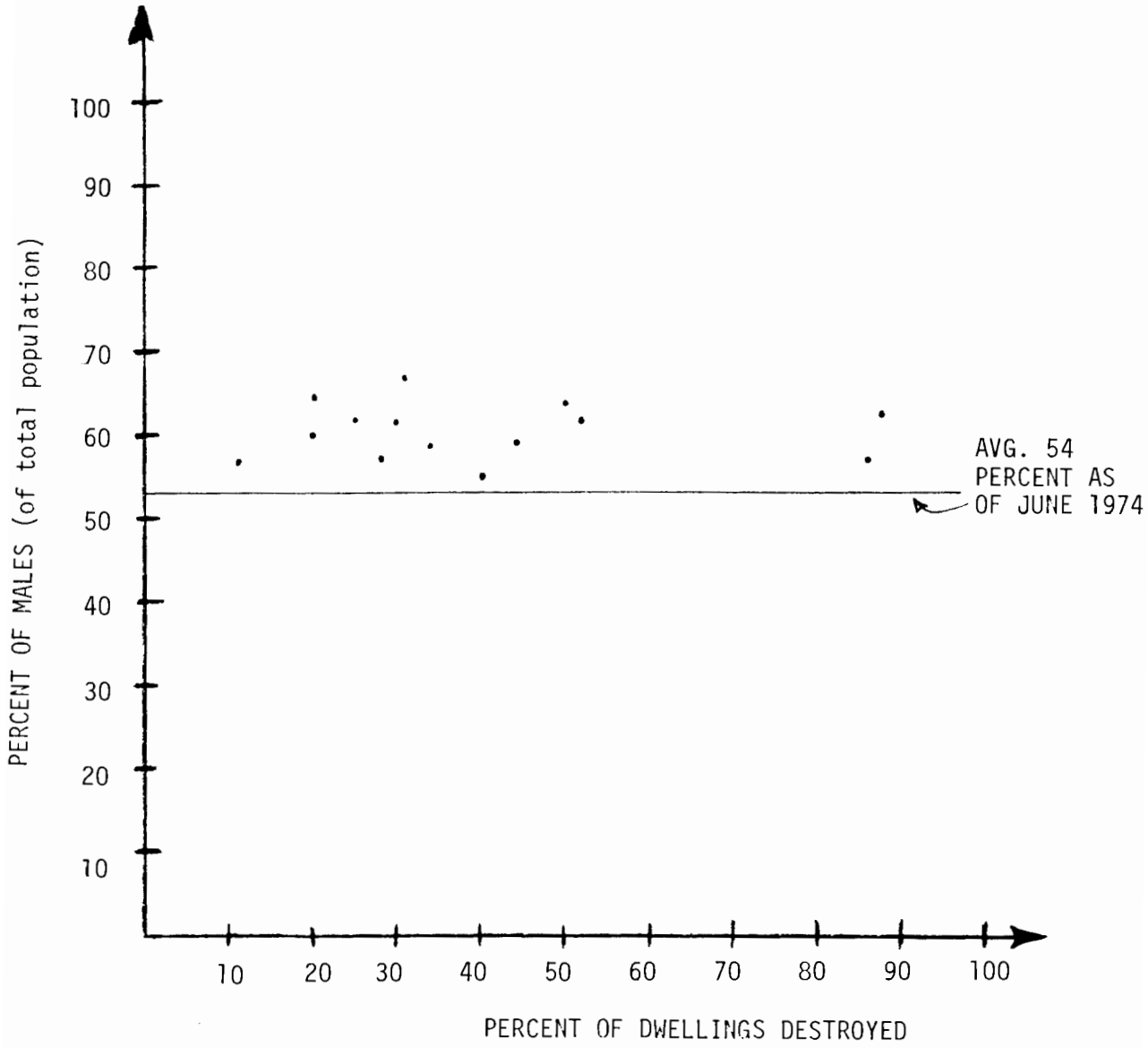
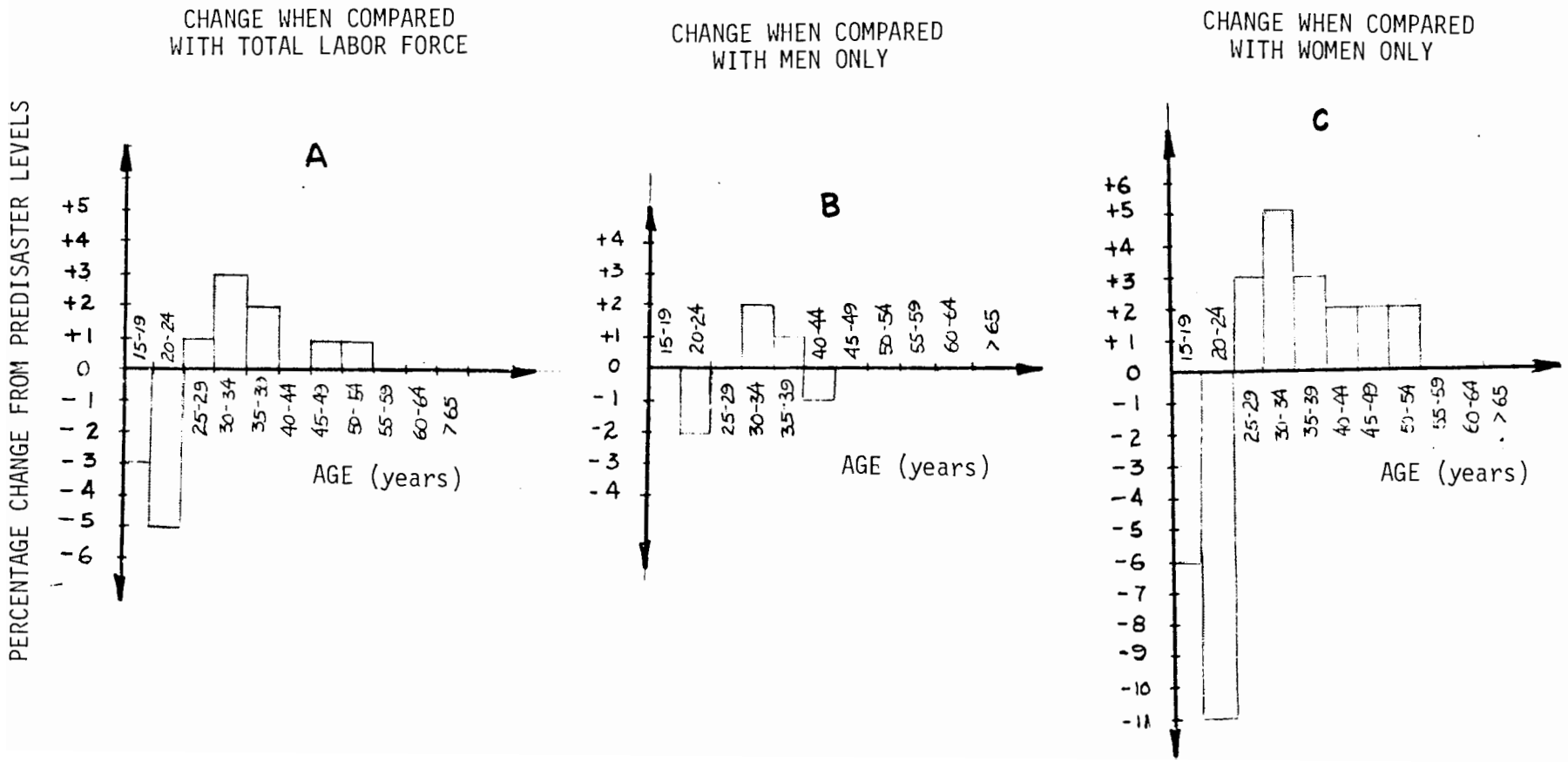


FIGURE 10

THE EFFECT OF DESTRUCTION ON THE RETURN OF WOMEN

FIGURE 11

CHANGE IN THE AGE MAKE UP OF THE LABOR FORCE
AS A RESULT OF THE EVACUATION



of the census data turned up another reason for the results shown in 11-A. If Darwin's current work force change is assessed with regard to an all-male work force, a much slighter shift in population would have been uncovered (Figure 11-B). However, when a comparison is made between the current work force age distribution and Darwin's distribution of female workers, the results shown in A tend to be amplified. (See Figure 11-C.) Apparently this change in ages is due solely to the fact that women have not returned as readily as men, for whatever reason, to take up their place in Darwin's work force. This may well be indicative of the "working and single mother problem" alluded to by a few of the Northern Territory Officials.

Can Darwin's businesses meet their needs without reliance upon outside sources of labor? For the most part Darwin has imported little labor. Of the 45 Businessmen interviewed, 30 indicated that less than 10% of their current work force was recruited outside Darwin (see Figure 12), Although they were often understaffed, they indicated a desire to await the return of former employees rather than actively seek their replacements. This tendency appeared more prevalent in the smaller wholesale and retail shope than in larger organizations. Banks, insurance companies and particularly those organizations which are branches of a larger parent company appeared more willing to make wholesale changes in their staffs, often replacing married employees with single ones so as to take better advantage of existing company lodging.

Figure 13 shows that employment levels for these 45 companies lag far behind that which they considered normal for March. Obtaining workers was mentioned most frequently (see Table 3) as the most severe

problem facing them as businessmen. The most obvious reason for this result is the limited lodging available in the city, and one of the prerequisites for reentry into the city (via a permit) is accommodations. A second and almost equally important reason for such a shortage of labor is the fact that government cleanup and reconstruction operations required large quantities of labor. These individuals absorbed into government service were often paid wages with which the private sector could not compete.

How did the evacuation affect the nature of Darwin's population? Because of the priority given different people in the evacuation schemes, it is not surprising to find that the predominant age group just after the evacuation's completion proved to be the group 15-69. As Figure 14 shows, the predisaster distribution of ages has yet to be reattained after three months, although it appears that the population is approaching "normalcy".

How quickly can the city be rebuilt? If the economic base is no restriction to the redevelopment of the region, then what is inhibiting resettlement? Obviously, based upon the analysis presented earlier, living accommodations must be considered the most important factor in prohibiting all those evacuated from returning. Cyclone Tracy left 8,000 homes completely destroyed and 4,000 severely damaged. The rebuilding of Darwin will severely strain the resources of the construction and trades in the greater Darwin area, for under normal circumstances they are capable of completing less than 1,100 houses over a one-year period. If efforts were tripled it would still take more than three years to replenish the housing inventory to its predisaster level.

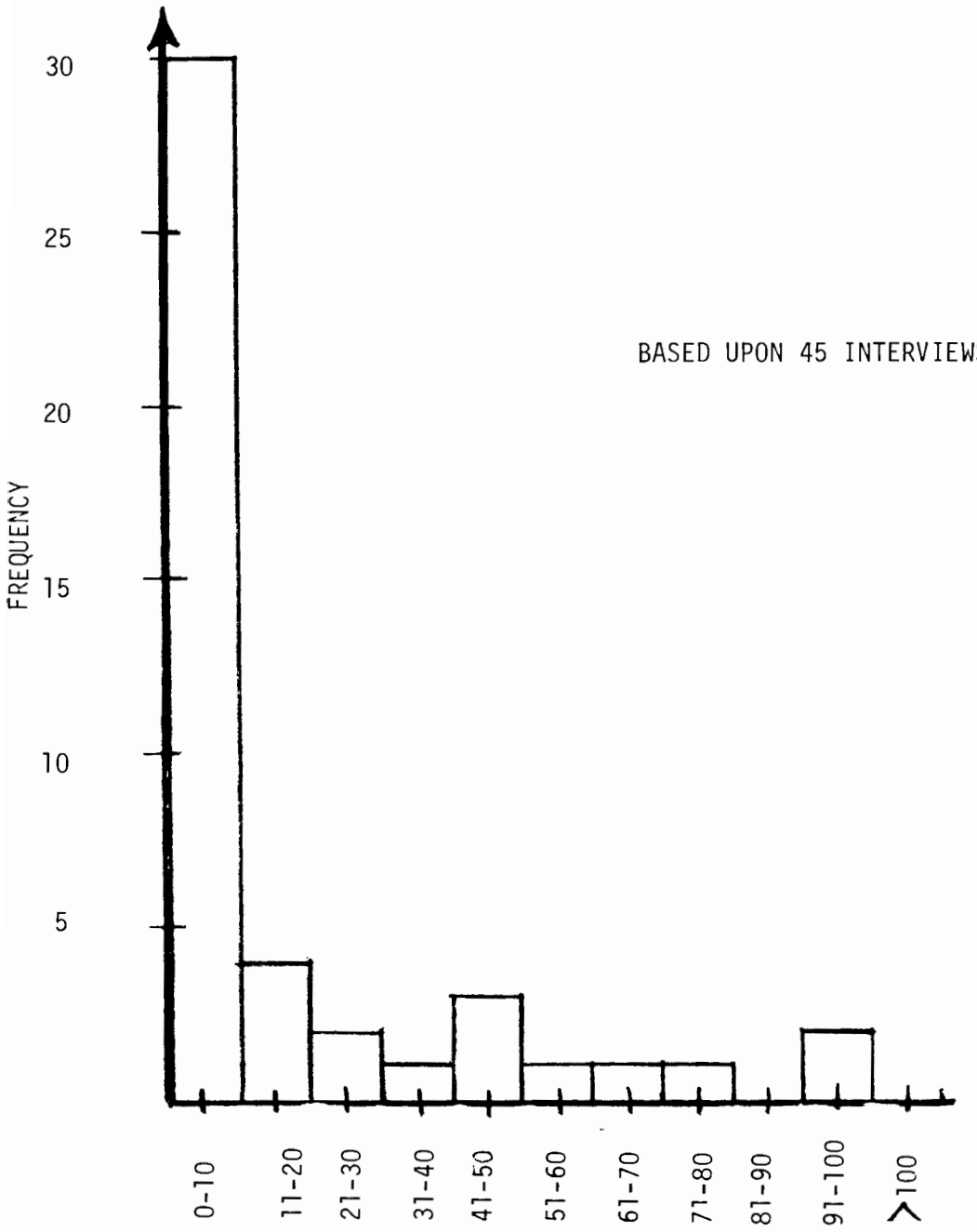


FIGURE 12

DISTRIBUTION OF THE PERCENTAGE OF CURRENT WORKFORCE OBTAINED FROM CITIES OTHER THAN DARWIN

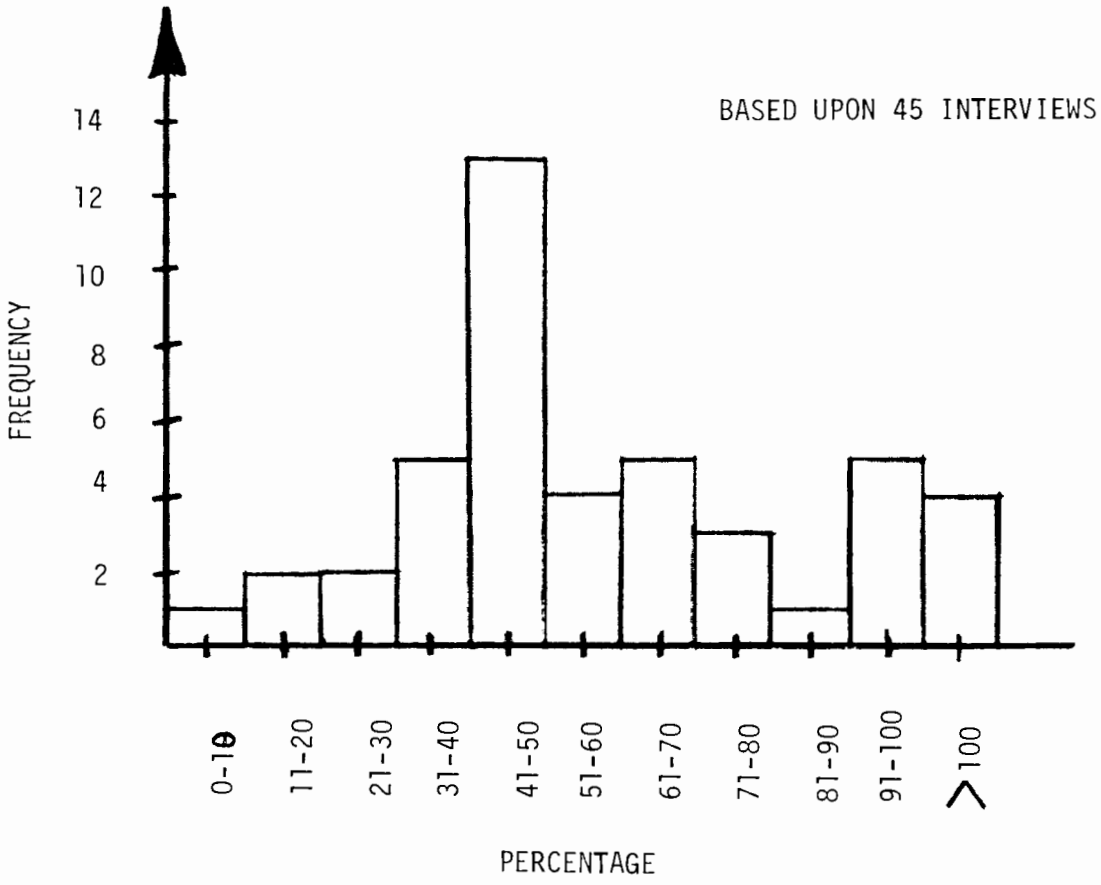


FIGURE 13

DISTRIBUTION OF POST-DISASTER EMPLOYMENT LEVELS
(March employment as a percentage of 1974 average)

TABLE 3

Frequency With Which Different Problems
Proved Bothersome to the Business Community
(Ranked by Frequency Mentioned)

Problem	Frequency of Response
Obtaining Workers	21
Obtaining Supplies	9
Obtaining Working Space	7
Cost Increases	6
Obtaining Capital	6
Other	4

Note: Some interviewees mentioned more than one problem. Consequently, the total shown is greater than the sample size.

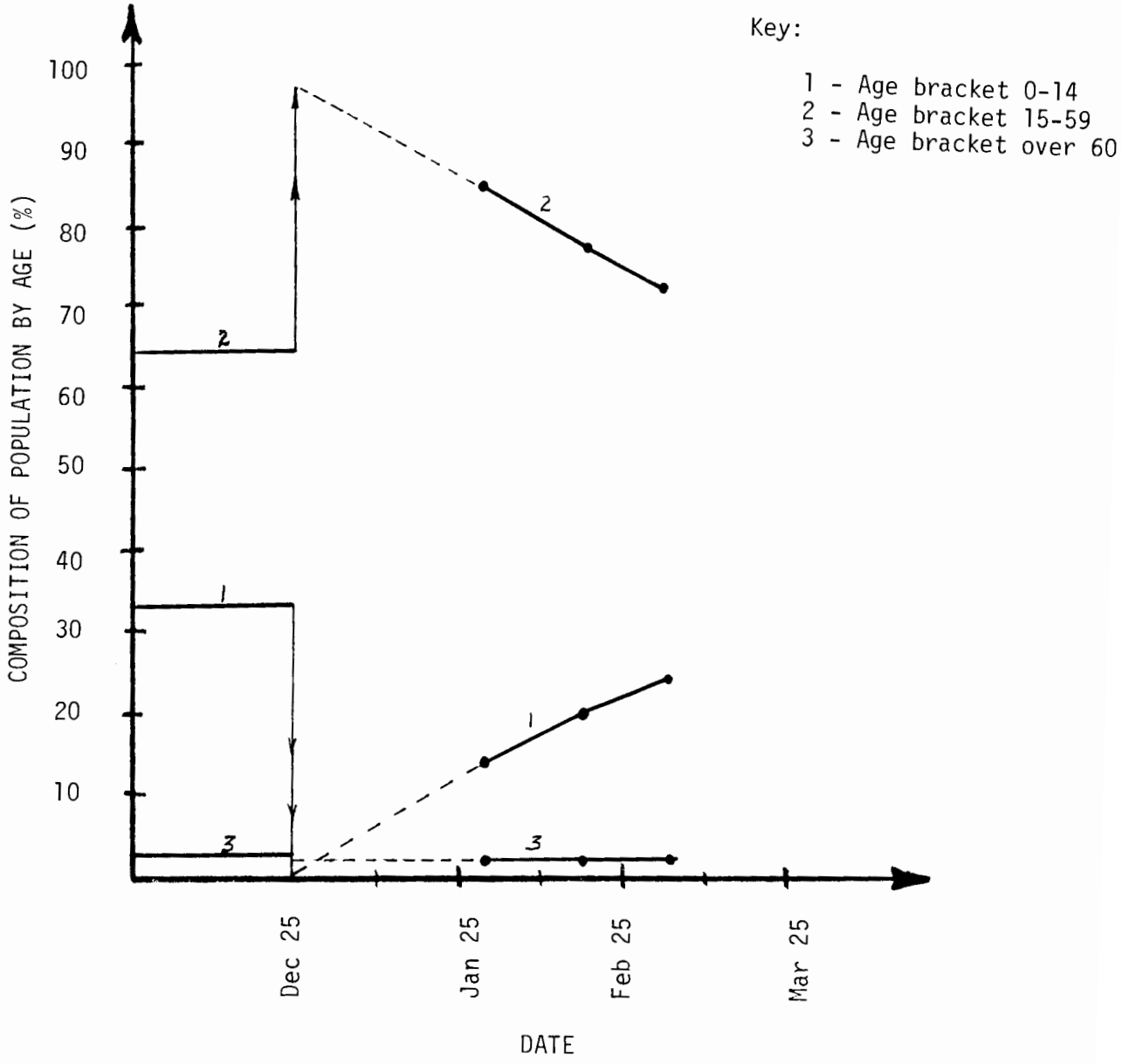


FIGURE 14

CHANGE IN THE AGE DISTRIBUTION OF
DARWIN'S POPULATION AS A RESULT OF THE EVACUATION

PRINCIPAL FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

This final section covers what are considered to be the principal findings and conclusions, especially those which may be of interest to the Federal Disaster Assistance Administration and other agencies which may be responsible for disaster-related activities. Where we believe it is important, we also offer some recommendations.

Emergency Operations

Several important lessons concerning emergency operations and evacuation were identified.

1. The absence of communications capability seriously affected ability to base decisions on accurate and comprehensive information. The capability to carry out decisions once made was limited and resulted in confusion and uncertainty. That no tragic consequence, such as a mid-air collision or related problems, resulted from an operation of this magnitude was extremely fortunate.

2. The lack of legal authority, arrangements with departments and agencies at each level of government and between levels of government was a serious deficiency noted by many officials from the Director General down to the Darwin community level. Many actions have since been taken to correct this problem. The need for disaster assistance preparedness cannot be overemphasized.

3. Large quantities of unneeded resources were transported into the Darwin area as the result of official government appeals for unspecified assistance; unspecified meaning a general term such as food rather than indicating a specific item if one were needed. Critical manpower and resources had to be diverted from essential activities to handle such matters.

4. The value of good predisaster working relationships cannot be overstated, as such relationships enabled key officials to fashion an emergency organization on an ad hoc basis. While the ten major committees concerned themselves with broad areas of responsiblity, there was a definite lack of necessary intercommittee communication and coordination.

5. Although the evacuation was voluntary, there was substantial inducement in the form of round-trip, first class air fare, monetary assistance, and certain other benefits. Many of the organizational, legal, social, and economic problems discussed in this report should be considered by FDAA, for evacuation could be a possibility in certain disaster situations, such as a devastating earthquake in a large population center during the winter.

6. Since the disaster, the Department of the Northern Territory has developed a substantial Emergency Committee. They have examined the demands of the disaster emergency and are providing for necessary organization to reflect these experiences.

Economics and the Return

1. Employment in Darwin was not constrained by the evacuation. The decision on the part of the federal government in Canberra to maintain the bulk of its activities in Darwin insured that an adequate economic base was sustained.

2. The fact that a housing shortage has materialized will insure windfall gains (profits and rents) for the few who were spared the destruction of Tracy's winds. Signs of this were already present by March, 1975.

3. Pressure to rebuild the city is mounting. The combination of this pressure along with new building codes will, over the next three years, result in a substantial inflation in construction costs.

4. Much of this inflationary pressure has yet (as of April, 1975) to materialize. However, by April the settlement of insurance claims was well underway. It is most probable that when individuals are ready to rebuild, construction costs will have risen by at least one-third over their current levels. This fact will add to the problem of underinsurance, which is already a problem of large proportions.

5. Tracy will turn out to be a stimulus to the slackened Australian economy. Construction activity amounting to almost $400 million represents almost 5% of the value added in all of Australian manufacturing operations.

6. A substantial portion of the funds for rebuilding will come from insurance companies. However, because most companies had reinsurance contracts with British insurance firms, it is likely that a significant proportion of the rebuilding costs will be borne by these firms. This fact will tend further to stimulate the Australian economy.

7. Local government finances and the economic viability of utilities should prove no constraint to Darwin's reconstruction. This is due to Darwin's unique and close attachment to the Australian Commonwealth Government.

8. Many of Darwin's larger businesses were branches of large organizations based in Sydney and Brisbane. As such, they were self-insuring and could readily weather any temporary curtailment in business activity. This point applies particularly to the banking sector.

9. It appeared from the limited sample of businesses contacted that the larger the business the more readily able to cope with the altered economic environment. This was primarily due to their ability to procure lodging (either by shipping in caravans or repairing company housing) for their employees. And, accommodations in Darwin remain the most formidable constraint to the return of the city's work force. Small businesses did not appear to visualize the possibility of providing housing for their employees as viable.

10. A substantial proportion of the population that has returned is living under conditions which would be viewed as unacceptable in other areas of Australia.

11. It appears that there is a lower percentage of young women in the labor force as of April, 1975 than before the disaster. Whether this is a result of overt discrimination is currently unknown.

12. It appears that physical destruction (the percentage of homes in an area totally destroyed) had little influence on the number of women and hence families returning. Sixty-four percent of the current population (in different areas of the city) turned out to be male regardless of the degree of damage.

13. The flow of insurance money into the banking system, expanding deposits by almost 3%, will cause some adjustment problems for both the banks and the insurance companies. How each institution adjusts to this situation and what implications this relatively massive shift in holdings has for the Australian economy is currently not well understood. Because all the banks in Darwin were branch banks, the adjustment process may be smoother than if local or state banks were present, as is the case in many American communities.

14. Mortgage foreclosure and delinquency was not a significant problem for the banking system as of April. This was partly due to a voluntary moratorium on payments. This voluntary action became mandatory with the passage of the Cyclone Disaster (Moratorium) Ordinance, 1975 (Northern Territory of Australia).

Impact of the Evacuation on Families

1. There was only slight resistance to air evacuation, despite the 50 pound per person luggage limit and the restriction which precluded most families from evacuating as a unit. (Only Aboriginals were permitted to go as a family in the first days.)

2. There was little internal conflict regarding evacuation within families.

3. There were no significant behavioral problems associated with evacuation.

4. The typical burst of altruistic behavior during the first four or five days after impact was quite evident in Darwin.

5. The informal, relaxed, out-of-doors life style of Darwin is highly valued. It provided skills and resources which proved valuable after impact.

6. Panic, looting and hysteria were almost nonexistent.

7. Mild forms of emotional disturbance among children were not uncommon for a few weeks following the disaster. Even though we asked respondents specifically about the matter, we did not find a single case of serious mental health difficulty at any age level.

8. Free, round-trip air fare to a preferred city proved to be a powerful incentive for evacuation. Equally significant is the fact that more than 10,000 persons evacuated 2,000 miles or more by automobile without any special financial incentive. It is likely that those who drove the 2,000 miles or more were not among the lower socioeconomic group.

9. Government employees continued to receive regular pay regardless of their location throughout the emergency and restoration period. This policy reduced the need for disaster assistance to a considerable degree. It also contributed to the speed of recovery in Darwin by permitting some employees to patch up their damaged dwelling much earlier than would have been possible otherwise.

10. The provision without any red tape of free food for more than three weeks and of cash benefits was eminently sensible, efficient and effective under the circumstances. Abuse of either program was almost nonexistent.

11. The policy of the government to provide free postage, telephone and telegraph service out of Darwin during the emergency period undoubtedly contributed to the speed and smoothness

of the departures from Darwin, placement of evauees in other cities, and the emotional well-being of separated families. Free local and long distance phone calls could also be made from the receiving airports by evacuees. Later efforts to provide free audio and video tape communication between Darwin residents and their separated kin brought a mixed response. The attempt to communicate via free copies of the Northern Territory News was apparently more successful, but here too, the moving population of evacuees was hard to follow.

12. After the first several weeks every government employee was given a two-week paid vacation with free round-trip air fare to a city of his choice outside of Darwin. This seemed to be an important stabilizing factor for the health and mental stability of the male heads of household and for the separated families.

13. The requirements for a reentry permit seemed reasonable to evacuees still away from Darwin. (Any person who was normally a wage earner had to demonstrate that he or she had a job waiting in Darwin. All persons had to show that they had a place to live if they returned to Darwin.)

14. Assistance for possible reentry to Darwin and information about what was transpiring in Darwin were provided by special information and assistance centers set up in the principal cities where evacuees were located. This tended to counteract the loneliness and isolation of evacuees living in a large, strange city. Many of these centers were manned by volunteers who were themselves Darwin evacuees. Government grants were provided for these centers, even though they were not officially part of governmental structure. This is a model that ought to be carefully considered in the United States for evacuations longer than a week.

15. For Commonwealth employees who could not return to Darwin within a month or two, a special effort was made to locate comparable employment positions in the city where the evacuee was located. This often required flexibility and special consideration on the part of the employing divisions or departments. In this type of situation such an approach makes more sense than the provision of unemployment compensation because it permits more rapid return to normal family patterns of living.

16. Acts of discrimination were reported by non-white evacuees. In Darwin such behavior is reportedly almost nonexistent. Children found it most difficult to cope with these new and demeaning experiences. In some instances they finally refused to attend school.

17. Children remaining in or returning to Darwin also had to make adjustments because many of their school friends were still gone, as were some of their teachers.

18. Despite the reentry permit requirement and other efforts to discourage reentry to Darwin, the population in March, 1975 had returned to an estimated 27,500, up from the low in early January of 10,000 to 11,000. Part of this growth was due to new residents since more than 10% of the children enrolled in Darwin schools in March, 1975 were not so enrolled in December, 1974, prior to the disaster. Darwin is and will continue to be faced with the problems that other communities have had to face after a widely publicized disaster--eager outsiders coming in to take advantage of the new "higher pay" job opportunities. Such immigration forces up the cost of housing and deprives those who have been hurt by the disaster of job opportunities. Serious considerations ought to be given to "local labor only" policies for all government funded or assisted recovery projects.

19. Some evidence suggests that civil servants and other families that have a history of several prior moves from one city to another were able to adjust to the upheaval of long-distance, long-time evacuation better than long-time residents of Darwin. This was especially the case for the Coloreds and Aboriginals of Darwin. Most of the Aboriginals, in fact, refused air evacuation and returned to the "bush" instead.

20. Life was difficult for families remaining in Darwin. No potable water was available at all through the city system for five days and it was almost three weeks before all of the habitable areas of the city again had water. The pattern was much the same for restoration of electric power and sanitary sewer service. As is usually the case following disaster, sports and other leisure activities were the last to return to some semblance of normalcy. Almost two months passed before organized recreational activities were begun again.

21. One of the greatest problems involved in long-term evacuation flows from living in an "artificial" setting. Family members define the place they live as strange and unnatural whether it is a hostel, military barracks, motel, private home of a stranger or even the home of a relative. There is almost always less privacy for family members; they have to come into contact repeatedly with persons not of their own choosing. Even where there are the best of intentions and much good will on all sides, interpersonal friction develops. This was an oft repeated story in interviews with Darwin evacuees. Indeed, one of the strongest reasons for wanting to return to Darwin at the earliest possible date was to escape the strange surroundings and interpersonal frictions.

Officials responsible for any aspect of long-term evacuation in the United States should be aware in advance of the very strong desire to return to the home community and of the reasons behind that urge to return.

On the Rebuilding of Darwin

As indicated earlier, talk of possibly relocating Darwin faded in a week or so. There was, nevertheless, continuing concern about rebuilding a safer city. The most frequently expressed notion dealt with how to rebuild residential structures so as to reduce damage significantly in the event of another cyclone hit.

Homes in Darwin are built for the tropics. They are mostly constructed on pilings and are of light weight construction containing many large louvered glass windows. The windows, combined with large yards, provide a feeling of openness, relaxation and informality of life style. Most homes are not air-conditioned.

Stronger houses and apartments, less vulnerable to cyclones, could, of course, be constructed in the rebuilding of Darwin. Window space would need to be reduced and the house would no longer be on pilings. Air-conditioning would then be required to make living in the house tolerable. But even if the added economic costs for these "stronger" homes were acceptable, their construction would probably be a mistake.

Look at the problem another way. Suppose the objectives were to build a city in a tropical locale at low cost and one which would have the open life style of Darwin. Suppose further that it was important to have the city built so that, should the rare cyclone strike (once every

50 years on the average), the loss of life and injury would be very low. If those were the objectives, you would build a city much like the Darwin of December 24, 1974. The damage was great, but the casualties of Cyclone Tracy were incredibly few in number.

The costs of building a "fortress" city are probably not acceptable when compared to Darwin's light weight residential construction. The added cost of energy for air-conditioning in the face of the foreseeable limited supply of energy in the world is also questionable. The type and quality of construction in Darwin may not be ideal in an abstract sense, but when faced with a tropical climate and the very rare cyclone strike it is probably as close to the "real world" ideal as most cities are likely to come.

ENCLOSURE 1

List of Questions with Summaries of Answers

A. Evacuation

1. What factors (e.g., geographic, logistic, economic) shaped the decision to evacuate the homeless?

Threat of immediate serious health problems was paramount. Cities that could receive large numbers of evacuees were at least 1800 miles away and thus the decision to concentrate on air evacuation.

2. Was there any pre-disaster plan for an evacuation? If so, was it implemented?

There was no plan for evacuation per se. Only the skeleton of a general emergency response plan was in existence. That general plan was utilized with considerable success.

3. Did the Commonwealth, Territory or municipal government have the authority to order evacuation? If so, how was that authority used and by whom?

Evacuation was not ordered in the technical sense. Some strong persuasion and incentives were used; e.g., free round trip air fare. The situation was so obviously desperate that the majority of those who did evacuate apparently did so quite willingly.

4. What were the logistics of the evacuation (e.g., actual number of persons affected, modes of evacuation, destinations of evacuees, facilities required to process evacuees at evacuation locations, accommodations provided to evacuees at such locations, including number of sites)?

Estimates vary somewhat, but somewhere between 23,500 and 25,000 departed Darwin by air within the first seven days after impact. Another estimated 10,000 to 12,000 left Darwin by auto during that period. Between January 10 and mid-March almost everyone else took a two week "R & R" leave from Darwin. Round trip air fare was paid by the government. Evacuees went to Brisbane, Sydney, Melbourne, Adelaide, Perth, and a few to Tasmania.

Overnight or very short term accommodations were provided in government owned hostels and military barracks. Longer term accommodations were private homes of relatives and friends, hostels and homes of total strangers who had volunteered space. There was never any shortage of living space.

Approximately 10 hostels were utilized and thousands of homes. Homes of friends and relatives were preferred by the vast majority.

Most of the processing was done at the airports, some at hostels, and later at specially established Darwin Disaster Assistance Centers in the major cities.

5. How many homeless were cared for within Darwin and its immediate surroundings? What kind of accommodations were they provided (e.g., tents, mass facilities, individual units such as vacant houses, apartments, hotels, motels, mobile homes, campers)?

The Darwin population was "thinned down" to approximately 10,000-11,000 persons. A study at the end of January, 1975 showed that available living accommodations were: houses - 3,000 persons; flats - 3,000 persons; motel and hotel accommodations - 2,000 (that figure was 1,000 on January 2, 1975 and 3,200 prior to the disaster). There were also said to be "less comfortable" accommodations for 2,700 persons in schools. Kitchen facilities and showers were limited.

Sometime between day 10 and day 30 approximately 4,000 houses were given new roofs. Tarps were made available free of charge. One thousand caravans were ordered by the government but by mid-March most had not yet arrived in Darwin. Business firms were reportedly more successful in getting caravans into Darwin, but the number received by mid-March could not be determined. (A caravan is midway in size between a camper and a full sized mobile home.) The train-highway combination was more often used than ships to bring in caravans and heavy supplies and equipment.

A Greek ship was leased to anchor at Darwin docks to provide living accommodations. It had a capacity of 600 persons but was still not filled in mid-March, 1975.

6. If accommodations were brought to Darwin to care for the homeless, what types were used, whence did they come and by what mode of transportation?

See discussion under Number 5 above.

7. What were the serious problems (if any) encountered in evacuating such a large number of persons (e.g., delays, accidents, casualties)?

Approximately 36,000 persons evacuated Darwin within six days after the disaster over minimum distances of 1700 miles during the monsoon season. Given the conditions in Darwin and the distances involved it is fair to say that there were no serious problems in the evacuation. There were long delays, in some cases up to 12 hours, at the refugee centers and/or at the crippled airport. For the elderly, infirm, pregnant women, and mothers of infants there was great discomfort and some suffering. However, given all the problems faced by the organizers, the air evacuation was really very well managed. There were no known accidents or casualties associated with the evacuation.

8. What socio-behavioral problems arose among the homeless and the evacuees (e.g., great anxiety, depression, disorientation, panic)?

No serious mental difficulties of any kind were found. A small minority of children, usually between ages 6 months and 4 years, were reported to have had short term problems, such as an unusual number of nightmares, excessive fear of rain and wind, and fear of falling buildings for up to six weeks following the disaster and evacuation.

Panic, looting and hysteria were almost non-existent. There were no behavioral problems whatsoever during the flights.

Many persons still away from Darwin expressed loneliness and a strong desire to return quickly. Persons remaining in Darwin throughout the first few weeks reported continuing physical exhaustion as a problem.

9. How long did the problems persist (e.g., hours, days, weeks)?

See discussion in Number 8 above.

10. Were any special arrangements made for disadvantaged groups (minors, old, crippled, chronically ill)? If so, what was their nature and how beneficial did they appear to be?

The injured and pregnant women were given the highest priority in air evacuation. The elderly, mothers of small children and other dependent persons received next priority. Once they arrived in the receiving cities they received quickly the regularly available services matching their needs. There were almost no complaints regarding these matters.

School age children received cash grants to purchase school supplies and clothing, usually uniforms.

Anyone injured in the disaster received the same compensation for which a person injured at work is eligible.

11. Were special arrangements made to keep family units intact? What were they and how successful were they?

During the first three days of air evacuation the priorities used resulted in families being separated. Later, however, complete families were permitted to evacuate by air. Considerable pressure was exerted for persons, mostly men, holding positions in emergency responsible organizations, to stay in Darwin for at least a month. Later all of them were urged to take a two week vacation away from Darwin using a free round trip air ticket.

Strenuous efforts were made to help separated family members keep in touch. This included free long distance phone calls, telegrams, and postage, and even free use of radio and audio tape recordings.

12. What possessions, if any, were the evacuees, permitted to take with them?

Those traveling by air the first week were permitted 50 lbs. per person. Within that limit they could take whatever they wished.

13. What level of government controlled the evacuation? What criteria were used to determine destination of evacuees? Who established such criteria?

The aircraft and flights were provided by the Commonwealth government. In Darwin the evacuation was planned and largely carried out by local officials and volunteers with coordination provided by the head of the National Disasters organization. The various states to which the evacuees went had responsibility for the processing and arranging to meet their needs. The whole process was liberally supported by Commonwealth monies.

Evacuees could go to the city of their preference. They might have had to stop once or twice enroute, however.

14. What was the organizational planning, including staffing and personnel, requirement for the evacuation?

Improvisation was the key description in Darwin and to a surprising degree also in the receiving cities. It was almost a totally new experience for every official and every organization. It could never have been accomplished without massive volunteerism. We heard repeatedly that the fact that most government offices were closed between Christmas and New Years was a great blessing. Those who did respond were thus quite unencumbered by the usual red tape and interdepartmental jealousies. Many persons reported proudly that rules were broken repeatedly in the process of promptly meeting the needs of the refugees.

15. Under what program or legislative authority was the evacuation conducted?

None. Much of it was extra legal. Appropriate legislation was enacted after the fact.

16. What was the impact of the evacuation on the economic life of Darwin (e.g., employment, unemployment, tax receipts, tax basis, shortages)? What level of government took what type of action to counteract the impact?

Darwin is a Commonwealth city. More than 45% of all jobs are with the government. The public services and government employment do not depend on local taxes but rather on Commonwealth funding. Unemployment has not been a problem because the government decided to continue most of the jobs in Darwin. This alone should insure the regrowth of the population to 36,000-40,000. It had already reached 27,500 by March 15, 1975.

The decreased population did produce lowered income for some businesses. Many businesses no longer exist, however, so those operating are not as hard hit as might be expected.

The only critical shortage is housing. It would be far worse had the planned evacuation not taken place.

B. Reconstruction

1. What effects, if any, did the evacuation have on reconstruction efforts (positive and negative impacts)?

From what could be assessed in mid-March, the evacuation had only modest impact on the primary focus of reconstruction--rebuilding homes and businesses. Those persons remaining in Darwin throughout most of the first 3 months were precisely the persons with the skills needed for rebuilding. Given the severe limits on housing, having more people in Darwin would have been, in balance, a hinderance.

On the other hand, the presence of predisaster Darwin residents makes it more likely that the rebuilt Darwin will be a more liveable or at least an acceptable city for the residents.

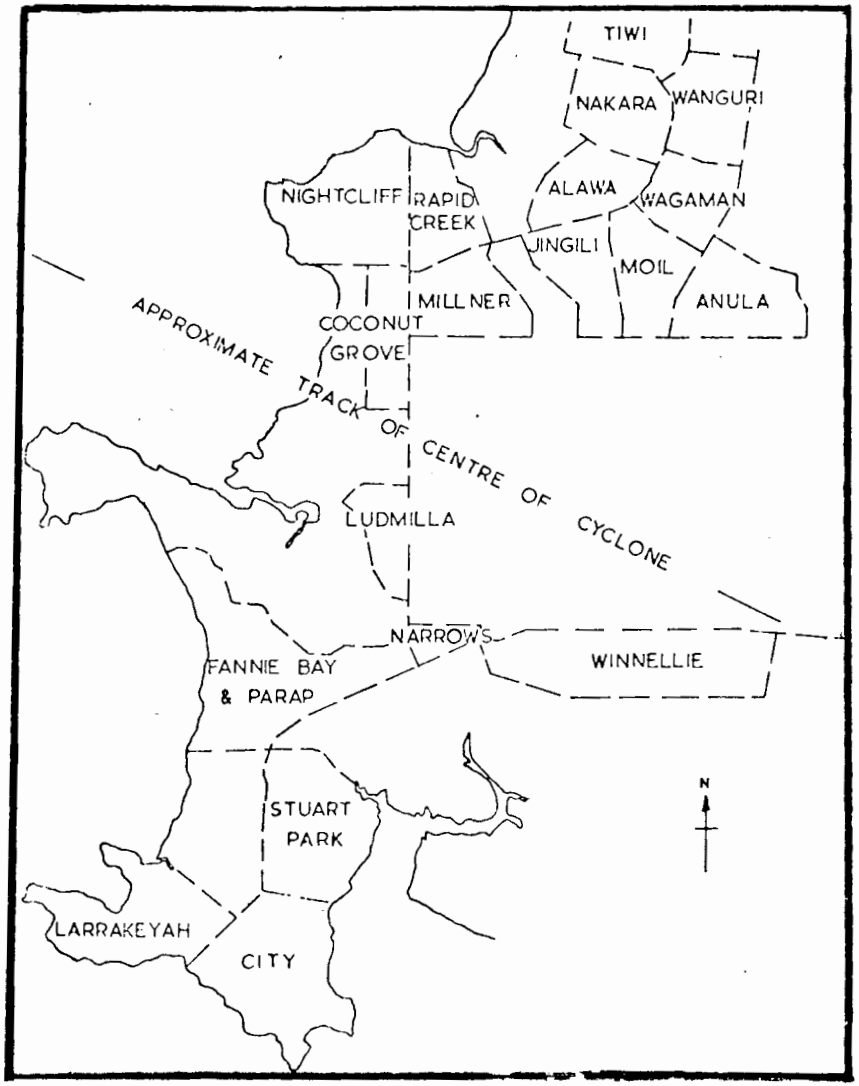
Citizen action groups have already effectively curbed some of the more "radical" designs of the professional planners.

2. What was the economic impact of the evacuation on different socio-economic groups?

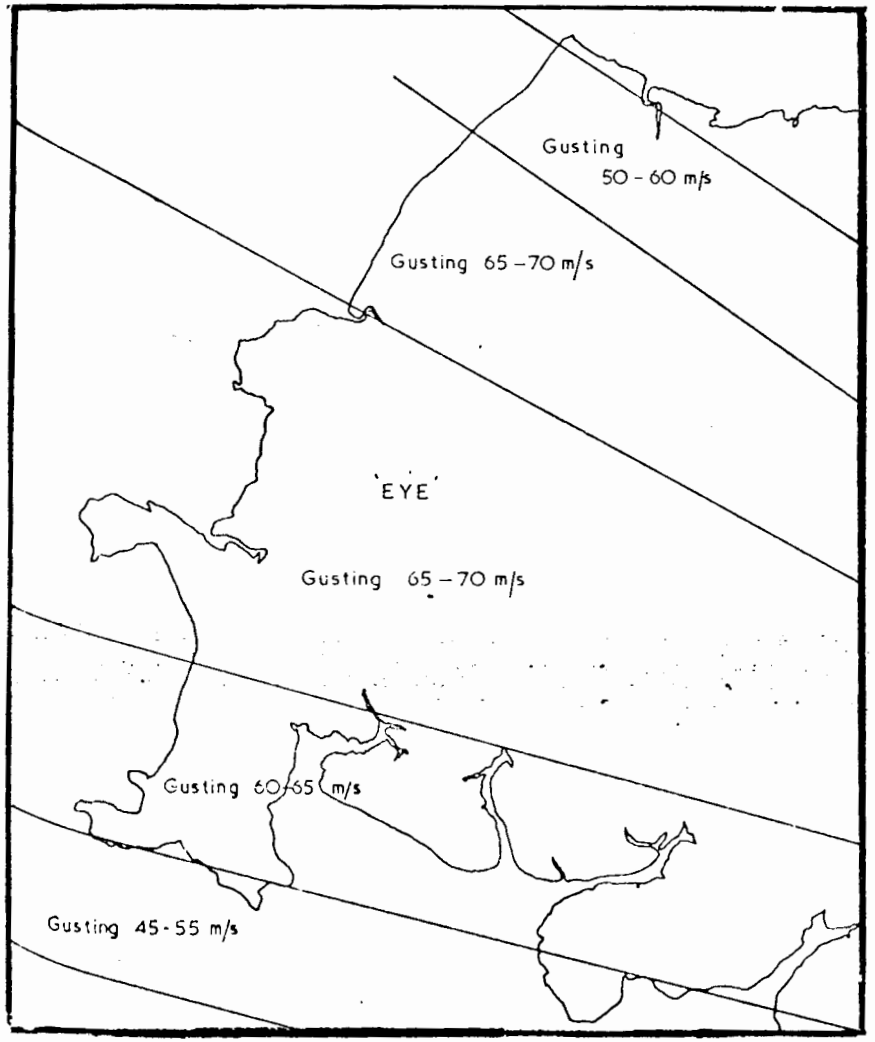
Few distinctions can be found on this topic. We do know that the Aboriginals went ot the bush instead of elsewhere, and appear to be slower in returning. We think, but are not sure, that those who drove out of Darwin are more likely to be middle class or above. Adequate data were not available to ascertain whether there was a systematic difference in the occupations of those who returned early vs. late.

ENCLOSURE 2

The City and the Event



DARWIN SUBURBS



APPROXIMATE WIND FIELD

ENCLOSURE 3

The Darwin Disaster Compared to the American Experience

Key:

- - - - XENIA TORNADO (APRIL, 1974)

——— RAPID CITY FLOOD (JUNE, 1972)

━━━ DARWIN CITY CYCLONE (DECEMBER, 1974)