Environmental Hazards and Society: Landsliding in Basilicata, Italy, with Specific Reference to Grassano

by

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Abstract

This dissertation takes a realist approach to examine landsliding in the Basilicata region of Italy, with specific reference to the municipality of Grassano, in order to understand humankind's role in contributing to environmental hazards. It concludes that environmental hazards such as landslides have partly-social causes, which are characteristic of the societies they affect, and any real accommodation with environmental hazards must involve radical social change.

The dissertation analyzes the differing explanations for environmental hazards given by previous schools of thought. Passing to the empirical material to be examined using these ideas, it describes the current pattern of landslides in Basilicata and discusses whether the reported landslide hazard has increased during the twentieth century. It then examines the physical environment of the region, and discusses the extent to which recent reported changes in the intensity of landslides are correlated to changes in the use of the land.

The example of the municipality of Grassano allows an examination of the causative mechanisms behind the regional trends. The dissertation examines the vulnerability of Grassano's physical environment to landslides, and the social factors which have influenced landsliding there. It then discusses the history of landslides in the municipality, and the extent to which they have intensified during the twentieth century. Finally it questions the degree to which reported changes in the level of landslides in Grassano have been the result of a growing sensitivity to landslides.

The dissertation's conclusion summarizes the work done, then evaluates the contribution to academic knowledge. It ends with an assessment of the viability of likely future approaches to reducing the landslide hazard in Basilicata.

Contents

The text 8

Preface 9

Acknowledgements 10

Chapter 1: Introduction 11

1.1 Introduction 11
1.2 Definition of the research problem 11
    1.2.1 Humankind and the environment 11
    1.2.2 Environmental hazards 11
    1.2.3 Mass movement and landslides 13
    1.2.4 The case-study area 15
1.3 The research's ontology, epistemology, and methodology 17
1.4 Overview of the research 21

Chapter 2: Environmental hazards 24

2.1 Introduction 24
2.2 Approaches to the environment 25
2.3 Hazards 26
    2.3.1 Approaches to hazards 27
    2.3.2 Behaviouralist research on environmental hazards 28
    2.3.3 Structuralist research on environmental hazards 31
2.4 Landslides as an example of an environmental hazard 36
    2.4.1 Introduction 36
    2.4.2 The approaches to landslides 42
    2.4.3 Landslides in the Mediterranean 44
2.5 Conclusions 51

Chapter 3: Landslides in Basilicata 53

3.1 The current pattern of landslides 53
3.2 Historical trends in landsliding 63
3.3 Conclusions 76

Chapter 4: The reasons for landslides in Basilicata 78

4.1 Introduction 78

4.2 The physical factors 79

4.2.1 Introduction 79

4.2.2 Relief 80

4.2.3 Geology 83

4.2.4 Tectonism and seismicity 87

4.2.5 Climate 88

4.2.6 Vegetation 92

4.2.7 Conclusions 96

4.3 The social factors 97

4.3.1 Indirect impacts on the land 97

4.3.1.1 Introduction 97

4.3.1.2 Deforestation 99

4.3.1.3 Agriculture 102

4.3.1.4 Urbanization 111

4.3.1.5 Industrialization 114

4.3.2 Direct impacts on the land 114

4.4 Conclusions 123

Chapter 5: Landslides at Grassano 125

5.1 Introduction 125

5.1.1 The landslides 125

5.1.1.1 The urban landslides 125

5.1.1.2 The town-centre paleoslide 127

5.1.1.3 Other landslides 137

5.2 The physical factors 138

5.3 The social factors 146

5.3.1 Deforestation 146

5.3.2 Agriculture 147

5.3.3 Construction 156

5.3.4 Land management 158

5.4 Conclusions 158

Chapter 6: The history of landslides at Grassano 161

6.1 Introduction 161

6.2 Environmental change before the twentieth century 161

6.3 Landslides in the twentieth century 165

6.3.1 Landslides from 1900 until the 1930s 167

6.3.1.1 The 1902 Cinti landslides 167

6.3.1.2 The 1903 Via San Sofia landslide 168

6.3.1.3 The 1907 landslide 168

6.3.1.4 Later landslides, 1907 to 1930 169

6.3.2 Other minor landslides 170

6.3.3 Urban landslides 171

6.3.3.1 The Cinti landslide 171

6.3.3.2 The Via Capolegrotte landslide 172

6.3.3.3 The Petrino landslides 172

6.3.3.4 Other landslides 173

6.3.4 The Calvario landslide 173

6.3.5 The cemetery landslide 181

6.4 Conclusions 185

Chapter 7: Managing landslides at Grassano 187

7.1 Introduction 187

7.2 The response to landslides 187

7.3 The management of hazards 190

7.3.1 The political response 190

7.3.2 Local people 193

7.3.3 Politics and research 203

7.3.4 The cemetery problem 208

7.4 Conclusions 213

Chapter 8: Summary and conclusions 215

8.1 Introduction 215

8.2 Summary of work done 215

8.3 Evaluation of work done and statement of limitations 220

8.3.1 The work done and its limitations 220

8.3.2 Further research 222

8.4 Contribution to knowledge 223

8.5 Discussion of significance of the findings and their application 226

Appendix A: The landslide-inventory maps 229

Appendix B: The regional landslide data 235

B.1 The historical data 235
B.2 Chi-square tests 235
B.2.1 Contingency comparisons of 1906 to 1910 236
B.2.2 Contingency comparisons of 1906 to 1986 236
B.2.3 Contingency comparisons of 1910 to 1986 237

Appendix C: Spending on landslides 239
C.1 Introduction 239
C.2 Urban landslides 241
C.3 General land reclamation projects 248

Appendix D: Geotechnical data on Grassano 254

Appendix E: The placenames of Grassano 257

Appendix F: Political power in Grassano 259
F.1 Introduction 259
F.2 Interviews with the mayors 263
F.3 Interviews with the councillors 264

Appendix G: The semi-structured interviews 266

Bibliography 275
Archives consulted 275
Sources 275

Figures

1.1 Basilicata 16

3.1 Basilicata: settlements 54
3.2 Oliveto Lucano 55
3.3 Basilicata: superficial instability 58
3.4 Basilicata: deep instability 59
3.5 Basilicata: landslides 61
3.6 Basilicata: urban landslides 62
3.7 Basilicata: consolidation orders for urban centres 68
3.8 Basilicata: urban landslides in 1906 70

3.9 Basilicata: urban landslides in 1910 71
3.10 Basilicata: urban landslides in 1986 72

4.1 Basilicata: relief 81
4.2 Basilicata: major rivers 82
4.3 Basilicata: geology 85
4.4 Basilicata: seismicity 89
4.5 Basilicata: precipitation 91
4.6 Basilicata: landuse 93
4.7 Italy: population 104
4.8 Basilicata: population 105
4.9 Basilicata: settlement sites 112

5.1 Grassano 126
5.2 Grassano: street plan 128
5.3 Grassano: slope instability 129
5.4 Grassano: urban landslides 130
5.5 Grassano: drainage and relief 139
5.6 Grassano: lithology 141
5.7 Grassano: geology 142
5.8 Grassano: districts 145
5.9 Grassano in 1662 148
5.10 Grassano: deforestation from 1860 to 1910 149
5.11 Grassano: population 151

6.1 Grassano: the Calvario district 176
6.2 Grassano: the cemetery 182

7.1 Grassano: consolidation (1988 Lire) 189
7.2 Grassano: land plots around the site of the proposed new cemetery 209

A.1 Basilicata: outline of landslide-inventory maps 230

C.1 Italy: price inflation 240

Tables

2.1 Factors affecting potential slope instability 38

3.1 Basilicata: proportion of the land affected by slope instability 56
3.2 Landslide-inventory maps: superficial and deep instability 60
3.3 Basilicata: urban landslide data 64
3.4 Basilicata: selected urban landslides 73
3.5 Basilicata: consolidation orders 76

4.1 Basilicata: the relationship between slope steepness and type of slope instability 83
4.2 Ferro Basin: the relationship between lithology and the type of landslide 86
4.3 North Calabria: the relationship between lithology and the size of landslide 86
4.4 Basilicata: selected climatic data for 1926 to 1955 90
4.5 Basilicata: landuse 94
4.6 Basilicata: landuse and landslides 95
4.7 Ferro Basin: landuse and landslides 96
4.8 Basilicata: changes in forest tenure from 1809 to 1870 101
4.9 Basilicata: reforestation from 1950 to 1980 102
4.10 Southern Italy: landuse from 1861 to 1970 109
4.11 Ferro Basin: artefacts and slope instability 113

5.1 Grassano: earthquake-damaged buildings in 1857 134
5.2 Tricarico: climatic data for 1926 to 1955 143
5.3 Tricarico: weather details 144
5.4 Grassano: proportion of land cultivated from 1929 to 1970 155
5.5 Grassano: landuse from 1814 to 1942 156

7.1 Grassano: spending at 1988 prices on urban landslides from the 1840s to the 1980s 190

The text

The dissertation's text follows the general prescriptions set out in Maney and Smallwood (1981), with spelling conventions following Fowler (1965). Those sources translated for this dissertation have been indicated. No attempt has been made to standardize quoted text, and all emphasis is as in the original quotations. A Harvard referencing system has been used - except for the archival material, which proved too complex for it to be workable.

Preface

I began this research, as I suppose most do, with nothing but a vague grasp of what my education should be about and what it should do for me. As I end it, I realize that it has become about many things - most importantly about my self-realization. This self-realization has been guided by my development as a professional researcher but it has, of course, also been much wider than that. Through my work I have come to examine, experience, and realize the common humanity, and common fate, that we all share. This experience is only new in the very personal sense that I had not grasped it with such clarity before. We all know it: we know it in the sensual practise of our everyday life - though it is only with intellectual analysis that we can clarify the experience.

My education has been directed by the clarified experience of others. An interesting parallel to this process was that of the writer and painter Carlo Levi, exiled to Basilicata fifty years before I went there. Levi, too, had the luxury of time to think, and suggested that Basilicata ("Lucania" as it was then known) had a vital emblematic quality, from which we can learn about ourselves and our experience.

> Certainly all that young man (and perhaps he was I) then experienced revealed to him the reality of a country unknown to him, and unknown languages, labour, toil, suffering, misery, and customs as well. There he came to know not only animals and magic, and ancient problems still unsolved, and the potency that withstands power, but also the pride that is ever present, a contemporaneousness that is inexhaustible, existence which is coexistence; the human being who is the locus of all contact; a motionless world of possibilities at once infinite and closed, the dark adolescence of centuries poised to stir and emerge, like butterflies from the cocoon. He learned the individual eternity of all this, the Lucania within each of us, the vital force that is ready to turn itself into form and life and institutions as it struggles with paternal, prevailing institutions which, despite their claim to an exclusive reality, are dead and gone. [Levi, 1982, 6-7.]

Yet the value of any emblem can only be understood with reference to its social significance, and I only came to begin to understand the significance of the "Lucania" within me... through an analysis of the everyday Basilicata. The facts are these:

I began this research in October 1985. It has been carried out part-time, and self-financed (with the exception of my six months in Italy in 1988 subsidized by the municipality of Grassano, and one further week there in 1991 that was allowed by a research grant from the Open University). I was first attracted to the idea of carrying out research in environmental hazards, and went to the LSE to be supervised by David

Jones and Judith Rees - Judith has now left for Hull University and her place has been taken by Michael Hebbert. At that time the LSE had contacts with the University of Basilicata, as well as two other research students in the field, Alistair Fulton and Gordon Mudge - so I began my research into the region's landslides.

The first eighteen months were spent in background reading and a literature review. My first trip to Basilicata, in April 1987, clarified my understanding of the research problem, and gave me contacts in Grassano. Between March and August 1988 I carried out my main fieldwork in Basilicata, followed by visits of two weeks in 1989, one week in 1991, and one week in 1992. Since 1988 I have been analyzing the data and writing and rewriting the dissertation.

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No-one works alone. The bibliography at the back of this dissertation indicates the scale of my debt to others. I have a great many thanks to make to a great many people, but I feel I should especially thank the following for their help:

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Chapter 1: Introduction

1.1 The research question

This dissertation examines the interaction between humankind and the environment by an analysis of landsliding in the Basilicata region of Southern Italy. Based on the appreciation that humankind has a profound and continuously increasing influence over environmental hazards such as landsliding, it takes as its research question the following: *how has humankind increased the intensity of the hazard from landslides in Basilicata, and why has this increase been caused?*

Through its analysis of Basilicata and the case study of the municipality of Grassano, the dissertation provides empirical material which allows a number of broader questions to be answered about society's involvement in environmental hazards and the physical and social obstacles to a harmonious relationship with the environment.

1.2 Definition of the research problem

1.2.1 Humankind and the environment

Since the mid-1980s the environment has once again become one of the major issues of social concern. This dissertation aims to contribute to the geographical literature on the environment and so to inform the debate by contributing to what Thrift (1992, 10) described as the "geography of the environmental crisis".

1.2.2 Environmental hazards

The study of environmental hazards is of great relevance to an understanding of the relationship between humankind and the environment. Humankind has progressively freed itself, through the application of technology, from the environmental restraints which afflict other animals. But this freedom is not absolute: humankind has not "conquered" the environment and will always remain at least partially subject to environmental hazards (see N Smith, 1990). Environmental hazards demonstrate the fragility of humankind's freedom from environmental constraints and the very practical need for humankind to remake a sustainable relationship with the environment which "meets the needs of the present without compromising the ability of future generations to meet their own needs" (Commonwealth Secretariat, 1990, 132).

This dissertation presents evidence which shows how great is the need for that reformed relationship. Hazards, and the disasters which they lead to, are very expensive in terms of lives and property. Thompson (1982) estimated that there had been a total of 1,062 major global disasters in the period 1947 to 1981 - each of which had caused at least 100 dead or 100 injured or $2.8 million of damage at 1982 prices. According to Burton, Kates, and White (1978) the worldwide cost of hazards in the 1970s was about US $40 billion a year - of which $25 billion were losses, and $15 billion were the costs of prevention.

In addition, the damage from hazards seems to be increasing. According to Berz (1990), between the 1960s and the 1980s the total economic losses from hazards increased by a factor of 3.3, and Wijkman and Timberlake (1984) claimed that between the 1960s and the 1970s the average annual death toll from hazards increased six-fold. As the discussion in chapter two of this dissertation shows, the increase in environmental hazards has prompted the appreciation that humankind can be a significant cause - so the old term "natural" hazard is plainly misleading. A number of social causes for this increase have been suggested, and they are discussed later in the dissertation with reference to landslides in Basilicata.

Academic research on environmental hazards has greatly increased in volume since the 1970s, stimulated by a run of very serious events such as the Sahel drought and the Seveso and Bhopal disasters, and there is now a very large literature on the subject (see J K Mitchell, 1990; Bryant, 1991; K Smith, 1992). As is discussed in chapter two, contemporary approaches to environmental hazards have been influenced by three ideological traditions which can be characterized, after Sandbach (1984) as:

- The conservative approach, expressed in the environmental-determinist literature on hazards which was the dominant paradigm for the limited research into environmental hazards written before the middle of the present century: that humankind is constrained by the environment and hazard is essentially unavoidable.

• The liberal approach, expressed in the behaviouralist approach to hazards: that humankind can be liberated from hazards by the management of technology.

• The radical approach, expressed in the structuralist approach to hazards: that a change in social institutions can reduce vulnerability to hazards.

The environmental determinist approach to hazards has been widely discredited by the recognition of the importance of humankind in the triggering and suppression of environmental hazards, but the debate on the merits of the behaviouralist approach compared to the structuralist approach continues. This dissertation's research question allows an assessment of the validity of those approaches through its examination of their ability to explain the hazard from mass movement in Basilicata.

1.2.3 Mass movement and landslides

Mass movements are geomorphological processes that "involve a transfer of slope-forming materials from higher to lower ground, under the influence of gravity, without the primary assistance of a fluid transporting agent" (Brunsden, 1979, 130). Mass movements can be classified in a variety of ways depending on the purpose of the classification systems which have been made (Hansen, 1984a; Crozier, 1986), and the most significant of them are landslides. Landslides are rapid mass movements involving some sort of slope failure (Varnes, 1978).

Environmental research shows that landslides, like any other environmental hazards, can no longer be identified as "natural" phenomena in the traditional sense. This is because the influence of humankind has become so pervasive that environmental processes are increasingly modified by social factors. As Johnston (1989, 199) explained: "understanding the nature of environmental problems and how they might be solved requires much more than a scientific appreciation of environmental processes. It demands an understanding of how societies work, and how collective action within those societies is both organised and constrained." Consequently, it is necessary to study both society and the environment in order to understand landslides.

Having both environmental and social causes, landslides provide a suitable focus for a critical examination of the two main approaches to hazards - because they allow a questioning of the major methodological debate in contemporary research: the behaviouralists' limited concern with the social element in hazards, and the structuralists' limited concern with the environmental element in hazards.

At the global scale landslides are an important hazard - despite the fact that, as D K C Jones (1992) recently showed, the damage they cause is often ascribed to other, triggering events such as storms or earthquakes. In its 1989 declaration of the 1990s as the International Decade for Natural Disaster Reduction, the United Nations made landslides fifth in the list of major global hazards behind earthquakes, storms, tsunamis, and floods (see K Smith, 1992). Bryant (1991) assessed the seriousness of thirty-one environmental hazards and rated landslides as the thirteenth most dangerous behind: drought, tropical cyclone, regional flood, earthquake, volcano, extra-tropical storm, tsunami, bushfire, expansive soils, sea-level rise, icebergs, and dust storms. And in his analysis of major global disasters from 1947 to 1981, Thompson (1982) listed landslides as having provided the seventh-equal largest number of events (out of a total of sixteen causes of disasters - though drought was not included): the major eight disasters and their frequencies were: floods (343), hurricanes (211), earthquakes (161), tornados (127), snowstorms (40), thunderstorms (36), landslides (29), and rainstorms (29).

Landslides, according to Crozier (1986) produce a variety of personal, economic, and environmental costs:

• Personal costs: range from physical and emotional hurt to death. Crozier drew on a variety of sources to produce a list of 31 recorded landslides which had caused 50 or more fatalities (with a total of 149,000 deaths). Twelve of these landslides had occurred in the years 1980 to 1983 alone, with a total of more than 2,000 deaths. Similar data is readily available elsewhere, for example in Cooke and Doornkamp (1990, 107). Crozier also cited International Red Cross data which suggested that worldwide between 1900 and 1976 landslides killed 3,006 and injured or left homeless another 44,637 - but he believed this to be a considerable underestimate. K Smith (1992) recorded that during the early 1970s an average of nearly 600 people were killed a year by slope failure (of whom 90% lived in the Pacific Basin, and most of whose deaths were also associated with earthquakes).

• Economic costs: range from the direct costs of landslides (especially to urban infrastructure) and the indirect costs (entailed indirectly as a result of landslide damage). Losses in the USA amount to between $1 billion and $2 billion a year from all types of ground failure, and major losses also occur in Indonesia, China, the former-USSR, and Italy.

• Environmental costs: include the damage done to the managed stability of the land by, for example, the disruption of drainage networks.

1.2.4 The case-study area

Information on the causes and consequences of landslides in the Mediterranean Basin is readily available, and they are well documented as a serious problem throughout the area. The problem in Italy is particularly interesting, the landscape being the product of a long struggle between humankind and the environment: as a consequence, King (1987, 139) noted that "Of all European and Mediterranean countries, Italy's rural landscape is the most humanized". Italy has a total of 50,000 ha (17% of the country) affected by severe slope instability, and about 400 km^2 of land is abandoned every year as a result of intense erosion - which contrasts with the 60 km^2 lost every year to road construction since 1964 (Alexander, 1982a). The economic costs of landslides in Italy were estimated to be $1.14 billion a year in the 1970s (Arnould and Frey, 1977).

Basilicata (figure 1.1) is a region in which landslides are extensive and well recorded. This dissertation concentrates on Basilicata because the region allows a comparison of past and present rates of landslide intensity; and an examination of the response to landslides, the factors which influence the nature of that response, and of the factors which determine the effectiveness of those responses.

The land in Basilicata is heavily degraded: it was described as "the most neglected region of Southern Italy" (Kayser, 1961, 5, translated); and Puglisi (1977, 97, translated) suggested that landslides and soil erosion are so serious and so closely related to the poverty of the region that "there can be neither lasting economic development without soil conservation, nor effective soil conservation without economic development". The "scourge" of erosion and landslides, and its effect on the environment was described by Regione Basilicata (1987, 41-42, translated) as follows:

> By the enormous damage which it produces, by reducing slope stability and so promoting landslides, accelerated erosion is a real scourge of vast areas of Basilicata. Basilicata is in fact one of the most damaged areas of Italy, both by the

Figure 1.1 Basilicata

> virulence of erosion and by the extent of the area affected. The countryside which it produces is among the most bleak and desolate. On vast areas absolutely devoid of vegetation, the action of erosive processes and landslides produces a morphology cut by deep and narrow gulleys, ravines, humps, thin ridges, escarpments, and landslides eaten into by calanchi... Among the calanchi features are numerous paleoslides, susceptible to partial or total remobilization, and also recent or current landslides which are often moving - now flowing, now moving translationally. Everything is obliterated by an aggressive erosion which softens the landforms and obscures the morphology of the landslides.

Basilicata is consequently "one of the regions of Italy where landslide phenomena are most intense" (Almagià, 1910, 145, translated); "one of the most impoverished regions because of climate... landslides... and... earthquakes" (Sion, 1934, 313, translated). A national survey of landslides by the Movimento Federativo Democratico (1987) demonstrated the severity of landslides in the province of Matera (the other province in the region, Potenza, was not surveyed - though as the data presented in chapter three shows the damage there is probably even more severe). On their semi-qualitative index of landslide damage, Matera scored 93% of the maximum score - much higher than the national average figure of 67%. Of the 81 reported landslides which they analyzed in the province: 19% destroyed inhabited buildings (national average 7%); 46% damaged crops (national average 25%); and 84% damaged roads (national average 72%).

The example of the municipality of Grassano allows a detailed analysis of whether the increasing regional intensity of landslides is a real one caused principally by destructive landuses, or whether this increase is partly exaggerated by a greater contemporary sensitivity to environmental hazards. Grassano is one of a sizable minority of towns in Basilicata where landslides have increased a great deal during the twentieth century. It is classed by the regional government as among the worst affected 42 of the 131 municipalities in Basilicata. It has been described as "affected by local landslide phenomena, of impressive size." (Lazzari, 1986b, 94, translated) and in a "fairly serious condition" (Regione Basilicata, 1987, 108, translated). A total of L5.5 billion is currently being spent on consolidating the town against landslides - the fourth highest figure for any municipality in the region.

1.3 The research's ontology, epistemology, and methodology

The dissertation was carried out using a structuralist ontology. This dissertation, as most structuralist interpretations of spatial relations, relies in particular on the work of Giddens (Thrift, 1983). According to Giddens (1981) "Social systems are composed of patterns of relationships between actors or collectivities reproduced across time and space" (ibid, 26); structure is "both the medium and the outcome of the practices which constitute social systems" (ibid, 27); and individuals are subject to structural influences whether they are conscious of them or not.

Soja (1985), Pred (1986), and Urry (1987) showed how the meaning of space has been theorized in a new way by geographers following the work of the structuralists, and is now widely appreciated as socially-constructed. According to Pred (1986, 2) "the 'becoming' of any... area involves the local coexistence of structuring processes which vary in their geographical extent and temporal duration and which concretely interpenetrate with one another through the time-space specific practices of mediating agents..."

With particular reference to the spatial relationship between humankind and the the environment, structuralist research has indicated that humankind has had an important role in changing the land by labour (Sayer, 1979, and 1983). In this it follows the work of Marx and Engels in recognizing that human beings are inseperably a part of the environment, and that human behaviour is structured by both social forces and natural forces (see Schmidt, 1981; Fitzsimmons, 1989; and N Smith, 1990). According to Peet (1985, 324) "humans are increasingly conditioned by what they collectively and historically have made of nature - i.e., by a 'second nature'." This change is a continuous process (Gregory, 1981) occurring through consciously-directed labour, and its unforseen consequences (Pred, 1986).

Based on its structuralist ontology, this dissertation takes a transcendental-realist epistemology (see Johnston, 1986). As Newton-Smith (1981) showed, "realism" has been used as a term to describe many differing outlooks in the philosophy of science, but all of them regard the validity of scientific principles as based on the "correspondence" theory of truth - on a validity based externally to the researcher. The basic claim of realism, according to Johnston (1986, 112-113) is that "the empirical world is the result of the actions of mechanisms that cannot be directly observed in particular contingent circumstances." This is because, as Chouinard, Fincher, and Webber (1984) pointed out, causal mechanisms will only produce empirical regularities in closed systems - but the open systems studied by social scientists can produce only tendencies because social mechanisms are the dynamic products of social action.

The growth in the importance of realist research in geography is, according to Sayer (1985b) part of a general movement away from positivism. While positivism aims to discover order, realism aims to discover structures - and is consequently better suited to the highly complex relationships discussed in this dissertation.

Realist research is of two kinds, according to Sayer (1984) - "extensive" and "intensive" research. Extensive research aims to discover regularities and patterns in the objects studied. Based on the analysis of taxonomic groups it aims to produce descriptive generalizations - though these are lacking in explanatory power (typical methods used include a large survey of the population or a representative sample, formal questionnaires, standardized interviews, and the application of statistical analysis). The power of extensive analysis is limited: although it produces representative results, generalizing to other populations or individuals from them is difficult; and they have a limited explanatory power. Intensive research aims to discover the mechanisms and processes behind objects or events, based on the analysis of causal groups (typical methods include the study of individual agents, interactive interviews, ethnography, and the application of qualitative analytical techniques). But the power of intensive analysis is also limited: although the causal powers discovered are generalizable, the specific patterns discovered are unlikely to be representative of other individuals.

Following from the dissertation's epistemology is its methodology, which follows the structuralist analysis of the political economy of environmental relations - "political ecology" (Emel and Peet, 1989; Atkinson, 1991). Political-ecology research indicates that the material conditions that act together as structuring factors do so in a way which is geographically specific. Pred (1986, 25) explained that this is because "the transformation of nature is inseperable from the local expression of structuring processes or from the historically contingent becoming of place, it it cannot be deeply understood under any particular set of circumstances unless the prevailing power relations at the core of local social structure are identified."

The issue of the transformation of nature has been developed in the literature on the political economy of environmental change (Redclift, 1984, and 1987; Blaikie, 1985; Blaikie and Brookfield, 1987). Redclift (1984) concluded that the neoclassical explanation of environmental degradation as a combination of environmental factors and poor land management is inadequate. He believed that poor management is the result of a complex relationship between the environment and the political and economic factors which control landuse, and is forced on local people by the destruction of the indigenous economy. Redclift later (1987) examined the reasons behind the breakdown of the relationship between humankind and the environment. He noted that suitable practices provide the only guarantee of survival for peasants. However, he suggested that this sustainability is prevented by the transition to capitalism which ensures that people enter into a new, more destructive relationship with the environment.

Blaikie (1985) developed Redclift's theme using the concept of "marginalization". Marginalization is the process by which peasants "lose the ability to control their own lives (where they live and derive their income, what crops or stock they produce, how hard and when they work)" (page 125). Marginalization forces farmers to exploit vulnerable environments as a result of an increase in the rate at which Marxian surplus value is extracted from them. "Under certain circumstances, surpluses are extracted from cultivators who then in turn are forced to extract 'surpluses' (in this case energy) from the environment (stored up fertility of the soil, forest resources, long evolved and productive pastures, and so on), and this in time and under certain physical circumstances leads to degradation and/or erosion." (Page 124.)

Blaikie and Brookfield (1987) set out to consider the relationship between farmers and the environment in what they described as "its historical, political and economic context" (page 239) to produce a political ecology which could account for both environmental resilience and social change. There are a number of problems with the concept of marginalization, discussed by Black (1990). First, some "traditional" land-management systems have been at least partially connected to the world economy for a long time - and by inference these links may not necessarily cause land degradation. Second, the inclusion of some farmers into the world economy is often welcome and may help to prevent land degradation. Third, Black pointed out that the relationship between people and the land depends for its effects on local relationships between people and their land.

In its analysis of these issues, with specific reference to land degradation in Basilicata, the dissertation's methodology combines both extensive and intensive research in a contextualized case-study approach. Its case-study approach fits into the geographical tradition of regional and local analysis (J F Hart, 1982), which has been linked in recent years with the renewed interest in locality studies based on realist methodologies (A Jones, 1988) - indeed Sayer (1985b) suggested that realist research is a new, theorized approach to the traditional ideographic approach in geography. The local research is carried out in the context of the region-wide pattern.

Basilicata is a unique region, but the landslides which occur there are the result of trends which have affected the whole Mediterranean and its climatic analogues. The complexity of the landslide hazard in Basilicata is such that it was desirable to choose a case study from within the region - which intensive research could place in the context of the regional pattern of landslides.

Grassano was chosen as a case study because of links with local people. It is representative of a significant number of municipalities in Basilicata where landsliding has increased. Research there was considered feasible because of the depth of the records, and because of the ergodic nature of landsliding - which provides a contemporary, documented example of a historical phenomenon. It consequently allows a causal explanation of the factors leading to landsliding, but an explanation that demonstrates how unique phenomena are the contingent products of causal mechanisms modified by geographically specific circumstances.

1.4 Overview of the dissertation

Following from chapter one's definition of the dissertation's research approach, chapter two discusses the nature of environmental hazards. It analyzes the implications of the three main approaches to environmental hazards: the environmental determinists, the behaviouralists, and the structuralists; then examines the development of these approaches. It concentrates in particular on the period since the development of a distinct hazards sub-discipline in the 1950s, and the extent to which they have recognized environmental hazards as influenced by society. It concludes with an analysis of landslides as hazards: the factors which cause landslides, the background to landslides in the Mediterranean, and the behaviouralist and structuralist literature on landslides. Based on the implications of the research on landslides for understanding the hazard in Basilicata, it sets out the research agenda for the dissertation.

Chapter three examines the extent of landslides in Basilicata, and their distribution. It describes in detail the landslide hazard to a number of the towns in the region. It then discusses the evidence from process studies, and archival and other historical records, which allows an analysis of the hypothesis that landslides have worsened in historical times - particularly during the twentieth century.

Chapter four examines the factors which determine the current and past levels of landsliding in Basilicata. It discusses how the importance of physical and social factors can be determined and the extent to which those factors have determined the current level of landsliding in the region, by assessing whether it is very much higher than the "normal" level which would have occurred without the presence of humankind. It then examines the regional physical factors which have made Basilicata a vulnerable region - relief, geology, tectonism and seismicity, climate, and vegetation; then the indirect and direct ways in which humankind has changed the land - by deforestation, agriculture, urbanization, industry, and land management. It concludes with an assessment of the degree to which humankind is responsible for the pattern of changes in landslides identified in chapter three.

Chapter five introduces the town of Grassano, which has been chosen as a detailed case-study for the dissertation. The chapter examines the factors involved in determining the intensity of the current and past levels of landsliding in the town. It examines the physical factors which have made Grassano vulnerable: its relief, geology, tectonism and seismicity, climate, and vegetation It then examines the political and economic factors which have affected slope instability: deforestation, agriculture, industry and construction, and land management. It concludes with an assessment of the extent to which these factors can account for the pattern of changes in landslides identified in chapter five.

Chapter six reconstructs the history of environmental degradation at Grassano, and the landslide hazard which existed at the beginning of the twentieth century, before going on to examine the numerous landslides which have affected the town since 1900. The chapter concludes with a discussion of the extent to which Grassano conforms to the regional pattern of change identified in chapter three.

Chapter seven examines the factors behind the "local discourse" on hazards which underlies the current approach to the land at Grassano. It examines the political and economic factors determining this discourse: the wishes of the electorate, local government, political clients, political protest, individual protest, and the role of research. The chapter analyzes the extent to which participants in the discourse are both empowered and constrained by current social structures, and the dominant ideological perception of hazards which those structures support.

Chapter eight provides the dissertation's summary and conclusion. It puts the example of Basilicata and Grassano in the content of humankind's general relationship with the environment, and draws together the main themes of the dissertation's thesis. The chapter assesses to what extent the dissertation has met its original objectives: to examine the changing nature of the relationship between humankind and the environment by an analysis of landslides in Basilicata. It summarizes the dissertation's findings, evaluates their strengths and weaknesses, then examines the implications which arise from their limitations, and the new research which they imply should profitably be examined in future research. The chapter then discusses the implications of the dissertation's findings for an understanding of the landslide hazard in Basilicata. It concludes with a discussion of the extent to which society has influenced the evolution of the land and its environmental hazards, the limitations which hinder the change of that influence, and the potential for changing it in the future.

Chapter 2: Environmental hazards

This chapter examines the concept of "nature", then reviews the literature on environmental hazards, discusses the suitability of that literature for explaining the origins of landslides, and sets out a research agenda to be followed in the rest of the dissertation.

2.1 Introduction

The environment is a topic of fundamental importance in geography, because the discipline developed in an attempt to integrate the "social" and the "natural" (Holt-Jensen, 1988; Rogers, 1992). The question of what nature actually is has recently been examined in a most interesting way by N Smith (1990). He suggested that, since the Enlightenment, western society has held two mutually contradictory views: that there is an "external nature" alien to humankind, and an "internal nature" which subjects humankind to unavoidable laws. According to his analysis, this has had two effects on society:

> First, nature has been tamed enough now that the hostile connotations are generally reserved for extreme, infrequent events such as high seas, floods and hurricanes. Whether hostile or not, the fact of the externality of nature is enough to legitimate nature's subjugation; indeed this process of subjugation has itself come to be treated as "natural". Second, and more important today, is the ideological function of the universal conception... to invest certain social behaviours with the status of natural events by which is meant that the behaviours and characteristics are normal, God-given, unchallengable. [Pages 15 to 16.]

According to Smith, humankind will only truly liberate itself when it can come to terms with these contradictory approaches and synthesize a new, holistic approach. Research into environmental hazards can enlighten this struggle because, as the remainder of this chapter shows, hazards demonstrate the nature of the environment - and it is only once the environment is understood that hazards can be tackled.

2.2 Approaches to the environment

The approach to the environment, and society's relationship to it, has always reflected the dominant ideas on the relationship between humankind and the environment (Glacken, 1967; Dobson, 1990). Since the Enlightenment there have been three main approaches to humankind's relationship with the environment: these may be characterized as the environmental-determinist approach, the behaviouralist approach, and the structuralist approach. Although any division of ideas into neat categories threatens to distort them (Sayer, 1989; Thrift, 1989) these boundaries will be followed here for the sake of clarity.

The environmental-determinist approach developed from the deterministic analysis of humankind's relationship with the environment. Like their Malthusian counterparts, the environmental determinists were by implication politically conservative, seeing humankind as constrained by the environment and "human nature" as in need of authoritarian control if it is to avoid the still-harsher control of the environment (Sandbach, 1984). They perceived the environment as "a set of resource constraints, or as a set of climatic and geologic features affecting the ease of settlement and certain forms of economic activity" (Palm, 1990, 58).

Although the concept of "nature" separated from humankind has continued in twentieth-century science (N Smith, 1990) the concept of environmental determinism has fallen out of favour since the beginning of the twentieth century (Johnston, 1986; Holt-Jensen, 1988). However, the influence of determinism still lingers, and Hewitt (1983, 5) noted that although the behaviouralist approach to hazards retained a dominant role for the environment in hazards, the "old unpalatable causality of environmentalism" was "swept away".

Behaviouralism (or "behaviourism" as it is also known) developed from the psychological study of behaviour. It assumes that "decision-making is the result of the operation of a set of laws, to which individuals conform" (Johnston, 1986, 28). Such is the influence of the behaviouralists on environmental research that they have been credited with virtually founding hazards research. Behaviouralism retains the environmental determinist concept of the importance of the environmental influence on humankind, but is also influenced by the possibilist perception that this influence can be modified (Palm, 1990). Like their technological-optimist counterparts, the behaviouralists are by implication politically liberal, seeing humankind as able to free itself of environmental constraints through the application of technology (Sandbach, 1984).

Structuralism, is based on the principle that "explanations for observed phenomena must be sought in general structures which underpin all phenomena but are not identifiable within them" (Johnston, 1986, 97). This principle implies that humankind's approach to the environment is conditioned by the political or economic factors which structure society (Palm, 1990). By implication , the structuralists are politically radical, seeing humankind as constrained not by the environment but by the structure of society (Sandbach, 1984).

2.3 Hazards

The threats posed to humankind by the environment have been perceived in a number of ways. Traditionally, they were perceived as "Acts of God". From the middle of this century, hazards research has regarded them as threats to humankind from "external nature": from "those elements of the physical environment harmful to Man and caused by forces extraneous to him" (Burton and Kates, 1964, cited by K Smith, 1992, 16). Many recent analyses have identified that society has an important influence, not just on changing hazards, but also in contributing to them. Consequently in this dissertation the misleading term "natural hazard", which implies a nature external to humankind, is replaced by the term "environmental hazard".

The assessed probability of a hazard occurring is a "risk", and the realization of a hazard can be - if severe enough - defined as a "disaster". The definition of disaster has in the past proved controversial, as K Smith (1992) explained. Definitions concentrate on the damage that events cause (though not on the benefits which may eventually stem from them) and disaster can be defined either by a threshold or by an assessment of its intensity. Threshold definitions include that made by Sheehan and Hewitt (1969) who defined a major global disaster as being an event that causes at least 100 dead or at least 100 injured or causes at least $1 million damage (the figure was updated by Thompson, 1982, to $2.8 million; and by Shah, 1983, to $3.6 million). Intensity definitions include that made by UNDRO (1984) as an event which threatens a community with "severe danger".

2.3.1 Approaches to hazards

The analysis of environmental hazards has a long history. Interest in the damage they inflict on humankind has existed for several thousand years (Covello and Mumpower, 1985). Yet an attempt to analyze the general nature of hazards is a more recent phenomenon, with its origins in the growth in knowledge about the environment that followed from the scientific revolution. According to J K Mitchell (1990), contemporary research into hazards has been divided into three relatively discreet sub-fields: risk analysis, disaster research, and environmental hazards research.

Risk analysis is "primarily concerned with the identification, measurement, and evaluation of risks" (ibid, 136). Early work developed principally from the need to evaluate the reliability of new technologies and products, and most studies continue to concentrate on technological hazards. Applying the results of risk analysis can be difficult: the complexity of systems, and particularly the possibility of synergies between risks can be difficult to forecast (Lowrance, 1986). The analysis of "revealed preferences" can give some indication of the risk which individuals, groups, and institutions are willing to bear (Starr, 1969). But the mental models which they hold can vary greatly (Fischhoff and others, 1981; Bogen and Spear, 1987) because the perception of risk is deeply imbedded in culture (Kunreuther and Ley, 1962; M Douglas, 1966; Douglas and Wildavsky, 1982).

Disaster research aims "to provide knowledge about group behavior and social life under stress conditions" (J K Mitchell, 1990, 136). Research began in the United States in the 1930s and became organized as a recognized sub-discipline in the 1950s: though before then, notable work had been carried out on the Halifax explosion (Prince, 1920), major catastrophies such as wars and famines (Sorokin, 1937), and the bombing of Germany and Japan (US Strategic Bombing Survey, 1947a and 1947b). Most disaster research has been for applied purposes (Morre and Feldman, 1962), and organizational behaviour under the strains of disaster has been perhaps its most important theme (Quarantelli, 1986). As a result of its concentration on the organizational reaction to events, rather than the environmental conditions which preceded them, it is closely linked to sociological research - though geographers are showing increasing interest in it (Varley, 1991).

Environmental hazards research is informed by risk analysis and by disaster research. It aims to examine the causes and consequences of environmental hazards. Since this is the research area of this dissertation, hazards research will be dealt with in more detail in the remainder of section 2.3.

2.3.2 Behaviouralist research on environmental hazards

Behaviouralist analysis of environmental hazards began in the 1950s. Principally under the direction of Gilbert White, it was based on the human-ecology work of Barrows (1923) and used "human ecological perspectives to investigate the interaction of human and nonhuman factors that generate, sustain, exacerbate, or mitigate hazards..." (J K Mitchell, 1989, 138.)

The behaviouralist approach to hazards draws heavily on the positivist analysis of society (Palm, 1990) and perceives hazards as the result of interaction between unpredictable "natural" hazards and vulnerable societies (Burton, Kates, and White, 1978). According to behavioural analyses, environmental systems are "in a vulnerable state of dynamic equilibrium punctuated by disasters..." (Marston, 1983, 340.) From Barrows it draws the perception of humankind as an independent component of the ecological system: according to which humankind is capable of changing the world, though is not necessarily deemed either a dominant or active in environmental processes (Hewitt, 1983).

In the behaviouralist approach, environmental hazards are perceived as the result of an imperfect (irrational) adjustment of humankind to fluctuating nature: "a natural hazard is an interaction of man and nature, governed by the coexistent state of adjustment in the human use system and the state of nature in the natural events system." (Kates, 1971, 438.) Disasters are perceived as aberrant fluctuations in a stable state (Heinrich, 1959; Scheidegger, 1975). According to Whittow (1980, 23) they "will only occur when there is a fluctuation in, or a malfunction of, the physical systems or processes which are said to be governed by the so-called laws of nature, because if the status quo is preserved then no disaster can be triggered-off".

The neo-Darwinian tinge to behaviouralist research on hazards implies the hazard as given and humankind's reaction to it as the problem, according to Marston (1983). Consequently, the behaviouralist approach describes the experience of hazards as dependent on the geophysical components involved: their frequency, duration, shape and size, speed of onset, spatial dispersion, and temporal spacing - modified by the vulnerability of society (Burton, Kates and White, 1978). The concept of vulnerability, modified by technology, is particularly important in behaviouralist research. Alexander (1991a, 220) put the case succinctly: all societies modify the environment through technology, but all are essentially reactive to the external nature and its "environmental imperative to society". However, "disasters... cannot truly be considered natural in that human vulnerability seldom results from purely natural states (rather than locational discourses based on socio-economic criteria) and human intervention often results in aggravated risk of geophysical impact."

When stimulated by external nature, the behaviouralist approach argues, societies are capable of progressively more effective adaptions to the environment to reduce their vulnerability (Burton, Kates, and White, 1978). The behaviouralist position has been made more sophisticated by a recognition of the impossibility of avoiding hazardous environments, and the potential role of humankind in making places more hazardous.

Behaviouralist writers argue that since technology has not allowed the total domination of the environment people will continue to live in hazardous areas because they provide superior economic opportunities, the time horizons of occupants is limited, or perceived benefits outweigh perceived potential losses (White, 1974). The more technologically sophisticated a society becomes the more it makes demands on its environment and changes it. White (1974, 13) argued that as a consequence of this increasing involvement, society becomes more vulnerable to hazards. "Certain of the hazards are created by man through his alteration of land and water or by his invasion of risky areas; others are exacerbated by his efforts to reduce the risk." Burton, Kates, and White (1978) characterized the adaptions made to the consequent risks as analyzable in discrete technological stages: preindustrial, industrial, or postindustrial in nature:

• Preindustrial - or folk - adjustments involve a wide range of modifications towards harmony with the environment. Adjustments are flexible and easily abandoned, low in capital requirements, require action only by individuals or small groups, and can be very localized.

• Industrial - or modern - adjustments involve a more limited range of technological actions emphasizing control of the environment based on the "techno-fix" of capital intensive works. They are inflexible and difficult to change, high in capital requirements, require interlocking and interdependent social organization, and tend to be uniform in their design.

• Postindustrial - or comprehensive - adjustments combine features of both the two earlier phases so as to involve a larger range of capital and organizational adjustments, and greater flexibility.

The contemporary approach to environmental hazards has been characterized as based not just in the application of sophisticated technology, but in its application of modern management techniques (Hewitt, 1983). The results of environmental managerialism have characteristic effects: in seeking to allow the regular, dependable use of the environment, management attempts to smooth those fundamental contradictions within society and the environment which hinder efficient production (Redclift, 1987).

The managerialist approach to environmental hazards has been criticized on two main counts. It has been argued that by attempting to smooth social contradictions it perpetuates the factors which lead to social injustice, and by seeking to smooth ecological contradictions while avoiding the radical solution often necessary for genuine solutions to be developed it perpetuates the factors which lead to environmental hazards (Dobson, 1990; Young, 1990). This is because managerialism is organized by bureaucracies - structured organizations employing their staff for a specific purpose or purposes (Weber, 1947). Bureaucracies require rigidity to ensure a dependable outcome of their work (Merton, 1957), and their structure ensures that they have their own prefered solutions to problems. This "bureaucratic dynamic" ensures that they develop stances which include implicit ideological assumptions.

Bureaucratic responses to hazards will tend to be in a series of small stages, because managers are restricted in their actions by a combination of their own limited understanding of events and the power structures they work within (Slovik, Kunreuther, and White, 1974) so they can only consider near-alternatives to the status quo as viable options. As Burton, Kates, and White (1978) argued, this approach has been a success in technical terms, but it has lacked a strategic coherence because bureaucratic management is by nature reactive management. Consequently, in order to avoid the political and social dimensions to environmental problems in capitalist countries, there is a tendency among managers to find a way out of debate by using a "technological fix" (Fischer, 1990). Miller (1985) claimed that most environmental problems are too complex for such an approach, and can only be dealt with adequately by addressing broader strategic issues.

Naturally, the behaviouralist approach to hazards has continued to develop since the paradigm was first established in an attempt to address these issues - most notably as a result of the significant growth since the 1960s in knowledge of the physical reasons for hazards (White, 1985). In addition to the quantitative improvement in knowledge there has been a qualitative improvement in understanding about hazards. New, "elusive" hazards have been identified, such as global warming, which were previously unrecognized (Kates, 1985). According to J K Mitchell (1990) "multiple crises" have been recognized - highly complex problems such as famine, pollution, and disease (Currey and Hugo, 1984; Clark, 1986) which are "quasi-natural" - having causes which are partly in the physical environment and partly in the social environment (Sorkin, 1982).

The identification of multiple crises has led to the suggestion that the rapid transition to radically new technologies since the industrial revolution has led to a greatly increased - rather than decreased - level of risk (Perrow, 1984). This tendency is evident in Burton and Kates (1986) which described a general trend of increasing risk since the eighteenth century ("the Great Climacteric"), initiated by the revolutionary changes in the organization of society which the development of industrial capitalism has produced.

The move to identifying social causes behind hazards is part of a general trend in hazards research in response to the new ideas on humankind's relationship with the environment, which developed in the late 1970s and 1980s when the relevance of the behaviouralist approach began to be questioned. A new paradigm began to emerge in hazards research based on criticisms of the social and political assumptions behind the behaviouralist paradigm.

2.3.3 Structuralist research on environmental hazards

Radical criticism of the behaviouralist approach to hazards developed following the perceived success of the Marxist critique of human geography in the early 1970s. The Marxist critique had offered an alternative, structuralist explanation of the world (Holt-Jensen, 1988) and rejected the liberal human geography of the sixties and seventies which had been dominated by the demands of policy-relevance. The new structuralist paradigm in hazards research attacked behaviouralist research for alleged inadequacies in aims, methodology, and findings. By the late 1970s a number of writings on the political economy of the environment had begun to show that there was the need to take into account what Marston (1983, 342) called the "social, political, economic, and historical determinants" of hazards; and to reject the behaviouralist paradigm because of its disregard of the socio-cultural causes of disasters (Waddel, 1977).

Criticisms of the behaviouralist approach first crystalized around the purported inadequacies of Burton, Kates, and White's *The Environment as Hazard* (1978). A number of reviews criticized the book for alleged academic failings - but also indicated unease with the state of hazards research. Torry (1979a, 377) criticized the book's failure to deal with political constraints on the reduction of hazards: "risk detection, warning, and mitigation, and the management of loss, are all governed by *systems of social institutions.* Recognizing how physical forces impinge on these systems to create hazard conditions, of course, is equally necessary." The book was, he concluded, "badly flawed by acute lapses of scholarship, dominated by feeble typologies, and lacking any unifying theory". For Hewitt (1980, 306) the book "floated" in an "intellectual limbo". He claimed its empirical evidence was too limited and prevented an adequate dissection of troublesome questions - notably analyzing why communities fail to adapt to hazards. Walker (1979) pointed to the books reliance on purposive rationality which (like Hewitt he concluded) prevented a discussion of the processes behind the "irrationality" diagnosed by Burton, Kates, and White.

The criticisms of *The Environment as Hazard* came at a time when discontent with inadequacies in the behaviouralist approach were growing - and, according to Marston (1983), encouraged that discontent. As Burton himself later admitted, there developed "a widespread feeling of discontent and dissatisfaction with the 'dominant view' in hazards research - the ship is leaking badly." (Burton, 1983, vi.) Critics began to suggest that the behaviouralist paradigm was oversimplified and ignored the political and economic factors involved in hazards. In the later words of Marston, (1983, 341) behaviouralist hazards research "has failed to examine the political and economic structures which influenced and very likely amplified the effects on population of extreme natural events." There were four elements in the critique of behaviouralism:

First, in behaviouralist research, hazardous events are perceived as in essence the product of the physical environment, rather than the work of humankind. Although, as

Hewitt (1983, 5) conceded, credit is given in behaviouralist analysis to the role of human involvement in hazards, the dominant role ascribed to the physical environment by the environmental determinists is retained: "Few researchers would deny that social and economic factors or habitat conditions other than geophysical extremes affect risk. The directions of argument in the dominant [behaviouralist] view relegates them to a dependent position... The implication always seems to be that disaster occurs because of the chance recurrences of natural extremes, modified in detail but fortuitously by human circumstances." As the information presented later in this dissertation shows, the work on the causes of hazards has consequently been dominated by natural-science approaches which concentrate on monitoring and forecasting changes in the environment - rather than analyzing the complexity of interacting physical and social causes.

In hazards research the perceived split between humankind and the environment has produced three strands in the technocratic approach to the alleviation of hazards: monitoring, managing, and relief. Monitoring involves "An unprecedented commitment to the... scientific understanding of geophysical processes" (Hewitt, 1983, 6). Managing involves "Planning and managerial activities to contain those processes where possible... and where it is not possible, physically to rearrange human activities in accordance with the objective geophysical patterns and probabilities." (Ibid.) Relief involves "Emergency measures, involving disaster plans and the establishment of organizations for relief and rehabilitation." (Ibid.)

Second, disasters are generally not perceived as the results of distributional extremes. "Hazards are taken as natural events that destabilise or *violate* ordinary life and relations to the habitat." (Ibid, 11.) Disasters, consequently, come to be symbolically alien to society (Legadec, 1990; N Smith, 1990), as an antithesis to "everyday" normality. Because they threaten the "normality" of social order disasters come to be described as "discontinuities", "islands of unorderliness" in a sea of "normal" everyday life. "The 'worst case scenarios' tend to become definitive or at least symbolic of the whole problem." (Hewitt, 1983, 11), and the litany of "megadisasters" is familiar in even the most respectable of texts.

Third, because of their supposedly random nature, disasters are seen as not capable of being planned for. By implication, though the intensity of disaster which the hazard produces can be modified, disasters cannot be prevented. Consequently the organizations which seek to manage hazards are absolved from blame for their occurrence.

Fourth, technology is seen as a potential cure for hazards because it allows for the production, management, and alleviation of problems (White, 1961). Hence Burton, Kates and White's (1978) emphasis on the role of technology in mitigation. As a result of this approach it has been claimed that behaviouralist research is in fact highly politicized - because its concentration on the technological fix as a means to evade environmental problems supports dominant economic and political interests (Torry, 1979b, Hewitt, 1983). "In the technocratic style of work there is a structure of assumptions, and a use of science and management that always situates natural calamity beyond an assumed order of definite knowledge and of reasonable expectation. More importantly, it places disaster outside the realm of everyday responsibility both of society and the individual." (Hewitt, 1983, 16.)

The criticism of behaviouralist hazards research allowed the conditions for the development of a new structuralist reinterpretation of hazards which its followers labelled the "radical" approach, in distinction to the "orthodox" or "dominant" approach of the behaviouralists (Hewitt, 1983).

The fundamental point of agreement among the structuralists was that it is possible to explain hazards from what Wisner, O'Keefe, and Westgate (1977, 48) described as the "human side of the man-nature relationship". The key text in developing the idea of a social component in hazard was O'Keefe, Westgate, and Wisner (1976). They argued that inspite of no major geological or climatological changes - and consequently no major changes in the probability of extreme events - the number of disasters had increased, and the cause must be a growing vulnerability of the world's population. This vulnerability had social origins, they concluded.

In 1983 Marston claimed that although a potential for developing a new paradigm existed, there was still not enough coherence among the anti-orthodox writers to be able to describe their approach as a paradigm. But in the same year Hewitt's *Interpretations of Calamity* gave a greater degree of coherence to the anti-orthodox writers, allowing the development of a genuine paradigm, based on a political-ecology approach later described as "linking society, political economy, and the environment" (Emel and Peet, 1989, 72). The essays in *Interpretations of Calamity* did not aim to break absolutely from the past of the orthodox approach but to salvage its findings and place them in a new intellectual context, as Hewitt himself (1983, 25) made clear:

> In isolation, of course, in the absence of the behaviourist view described, our emphases would also add up to an unbalanced view. It would be wrong to suggest

> that events with flood or earthquake in no way reflect the nature of these geophysical processes. It would be indefensible to argue that the disruption occasioned by disaster produce no distinctive, even unique, crisis phenomena. There are particular aspects of hazard that can be helped by improved geophysical forecasting. Nor are any forseeable human actions going to remove the need to bring emergency assistance to ill-equiped victims of natural calamities.

In contrast to behaviouralist research, structuralist hazards research started from the concept that humankind is increasingly coming to have primacy in causing hazards. Its three main principles were summarized by Hewitt (1983, 25):

First, "Most natural disasters, or most damages in them, are *characteristic* rather than accidental features of the spaces and societies where they occur." The increasingly significant interaction between humankind and the environment is well established, and consequently the nature of society will have an influence over the form of hazard which affects it.

Second, "The risks... flow mainly from what is called 'ordinary life' rather than from the rareness and scale of those fluctuations." As Dury (1980) and Kirby (1990a) showed, western society has become acutely aware of catastrophes in the years following the second world war. But catastrophes are only extremes, and they are as much a part of dynamic environmental systems as "normality".

Third, "The natural extremes are, in a human ecological sense, more expected and knowable than many of the contemporary social developments that pervade everyday life." (Hewitt, 1983, 32.) This is the heart of the problem. The advance of the natural sciences now allows the prediction or forecasting of many environmental changes, and the case of landslides shows how the occurrence of many hazards is often predictable and can be ameliorated (D K C Jones, 1992). Given the proposition that hazardous events are partially caused by society, it follows that their solution must be partly social too. Hazards research, aiming to be part of this solution, must be involved in issues which are not purely technical but are also political (Hewitt, 1983; Blaikie, 1985). What is needed is for there to be scientific knowledge and the social commitment for that knowledge to be used effectively.

> Research on natural hazards shows them to be complex phenomena. The behaviourist approach to natural hazards stresses the importance of environmental phenomena as the cause of hazards, the radical approach to natural hazards stresses the importance of society as a manipulator of the environment. Indeed, the political-economy approach to hazards suggests that they tell us a lot about society: "in this view, environmental relations are instances of the production process and adaptive strategies or coping responses are grounded in the social relations of production in concrete historical circumstances;

> calamities thereby yield valuable information about the stricken society."
> [Watts, 1983b, 26.]

The following section analyzes landslides in the light of the potential they offer as an example of an environmental hazard, and discusses the respective importance of physical and social causes.

2.4 Landslides as an example of an environmental hazard

2.4.1 Introduction

Landslides are an important global hazard: yet there is relatively little emphasis on them in the environmental-hazards literature, as chapter one indicated. Bryant (1991) claimed landslides as the thirteenth most significant hazard worldwide - yet devoted only twenty pages of his 352-page book to slope instability of all forms (pages 236 to 256). K Smith (1992) allocated only eighteen of 352 pages to mass-movement hazards (pages 160 to 178) of which just three were on rockfalls and landslides (pages 162 to 165). And in Hewitt's *Interpretations of Calamity* there are just two references to landslides compared to drought, the most important, with twenty-six.

Paradoxically, the relevant literature is in precisely inverse relationship to the importance of landslides for hazards research - because it points to the "difficult-to-explain" nature of the hazard they pose. The complex nature of the causes behind landslides begs questions which neither the behaviouralist school nor the structuralist school fully explain. This dissertation argues that landslides are extremely varied phenomena and have a number of causes: it acknowledges that they are environmental phenomena, but show that in recent history they have increasingly been influenced by society.

Assessing the very complex causes of landslides can be difficult: it is also potentially an irrelevant process because abstract analyses of causation can, to quote Sayer (1985a, 50) "only remain agnostic, or make conditional statements about what actually happens". According to Crozier (1986, 37-39) the conditional statements it is possible to make are that: transient triggering factors cannot alone be held to be the "cause" of a landslide. Triggering factors play only a part in causation, and attention must be paid to passive factors that tend to change only slowly. These important passive factors "may have brought the slope into a condition in which a minor change of regular occurrence could precipitate movement" (ibid, 38).

The geotechnical factors involved in slope instability, the condition that leads to slope movements including landslides, were explained as follows by Crozier (ibid, 32):

> In every slope there are forces (more accurately described as stresses) which tend to promote movement (shear stress) and opposing forces which tend to resist movement (resistance or shear strength). "Stable" slopes have a *margin of stability* equal to the excess of resistance over shear stress. Slopes at the point of movement, on the other hand, have no margin of stability, and resistance and shear stress are approximately equal. "Instability" in any slope represents the condition in which its margin of stability can be reduced to zero.

Slope instability is determined by the nature of a slope, modified by factors external to the slope which cause changes within the slope. The nature of a slope is a product of external factors (location factors such as climate, and site factors such as inclination) that interact with inherent factors such as material strength (which can be modified by changing circumstances over time). Slope instability can be seen as the result of both preparatory factors (which predispose a slope to movement), triggering factors (which initiate movement), and controlling factors (which dictate patterns of movement on a slope).

In most slopes, the relationship between preparatory, triggering, and controlling factors is both highly complex and changeable. The range of factors that can influence slope stability is very large (table 2.1) and dealt with in detail by Crozier. The range of factors includes both "natural" and "social" factors - often acting together. At different times many factors may act to prepare, or trigger, or control a given slope.

The way in which these factors work together can be highly complex and is naturally dependent on the scale chosen for analysis. At a regional scale the most significant factors are: relief, geology, tectonism and seismicity, climate, vegetation, and human involvement.

Relief can have a profound effect on landslides. Crozier (1986) showed that the probability of slope instability is increased by the presence of deep valleys, steep slopes, cliffs, and concave valley slopes. In addition, the probability of landslides is also increased by drainage characteristics associated with steep relief - including high drainage density, steep river gradients, and slope undercutting - which all promote local steepening of slopes. Deep valleys lead to increased slope heights, steep slopes act

Table 2.1: Factors affecting potential slope stability (source: Crozier, 1986, 216-218)

Factor	*potentially stable*	*potentially unstable*
Relief		
Valley depth	small	very great
Slope steepness	low	very steep
Cliffs	absent	present
Height difference between valleys	small	very great
Valley-side shape	convex	concave
Drainage		
Drainage density	low	very high
River gradient	gentle	very steep
Slope undercutting	none	very severe
Concentrated seepage	absent	present
Standing water	absent	present with rapid drainage
Recent incision	absent	large
Porewater pressure fluctuation	low	very high
Bedrock		
Joint density	low	very high
Joint openings	tight	wide
Joint fillings	soft	hard
Joint wedging (by vegetation and soil)	absent	present
Tension cracks	absent	present
Strike direction of structural discontinuities with respect to strike of slope	right-angles	parallel
Dip angle of structural discontinuities with respect to slope angle	greater	lower
Competent over incompetent strata	absent	present
Degree of weathering	none	high
Compressive strength	high	very low
Glauconite in contact with pelitic rocks	absent	present
Existing landslides	none	many
Activity of existing landslides	none	high
Regolith		
Site	flat	steep slope
Coherent over incoherent beds	absent	present
Depth	small	very large
Shear strength	high	very low
Plastic index	low	high
Liquid limit	high	low
Activity number	low	high
Desiccation cracks	absent	present
Tension cracks	absent	present
Permeable over impermeable beds	absent	present
Nature of regolith/bedrock contact	gradational	abrupt
Subsurface depressions and drainage lines	absent	many
Existing landslides	none	many
Activity of existing landslides	none	high

<u>Earthquake zone</u>		
Tremors felt	none	many
Felt intensity	low	high
Proximity to fault	close	far
<u>Paleo-features</u>		
Fossil solifluction lobes and sheets	absent	many
Fossil gulleys	absent	many
Previous landslides	absent	many
Deep weathering	none	much
<u>Climate</u>		
Rainstorms	low intensity	high intensity
Total rainfall variability	low	high
Drought episodes	uncommon	common
Snow-cover melt	slow	rapid
Freeze-thaw cycles	few	many
Cyclones	few	many
<u>Vegetation</u>		
Hydrophitic plants	absent	present
Potassium-demanding plants	absent	present
Biomass on steep, jointed slopes	low	high
Biomass on other slopes	high	low
Recent alteration to biomass	none	much
<u>Artificial features</u>		
Excavation depth	small	large
Excavation position	top of slope	toe of slope
Fill compaction	high	none
Reservoir	absent	present
Drainage diversion across hillside	absent	present
Fluctuation of reservoir level	small	large
Loading of upper slope	none	much
Maintenance of control structures	high	low

to increase shear stress on the slope. High drainage density, steep river gradients, and slope undercutting all promote local steepening of slopes.

Geology, as Crozier (1986) indicated, can have profound influence on slope instability - an influence which he divided along lines based on lithology and regolith. The lithology of a slope and its structure determine the ability of the slope to resist instability: the greater a slope's inherent strength, the more it will resist. Slope stability varies significantly with the type of slope-forming material. Given an erosional slope in equilibrium with its environment, the slope angles will be a function of rock strength, but these conditions are rarely attained and for a constructional slope the angle of repose will be the most important factor in determining the frequency of slope instability.

The strength of slope-forming material depends on whether, in engineering terms, it is a rock (having "true cohesion") or a soil (having "apparent cohesion"). The behaviour of rock is determined by rock-mass strength - a relationship between intact strength and discontinuities within the rock. The behaviour of soil is determined by a combination of particle size and mineralogy - modified by dilatancy, which eventually will produce a residual cohesion in the soil. In rock, the susceptibility to slope instability is overwhelmingly determined by the presence and form of discontinuities; but in soils it is determined by the strength of interparticle bonding and the soil's ability to take up water.

Structure is important because the probability of slope instability is increased by: the presence of high joint densities, wide joint openings, hard joint fillings, joint wedging, tension cracks, structural discontinuities with a strike direction parallel to the strike of slope, angles of structural discontinuties lower than the slope angle, the presence of competent over incompetent strata, intense weathering, low compressive strength, the presence of glauconite in contact with pelitic rocks, and the presence of existing landslides. The nature of the regolith is important because the probability of slope instability is increased by: the presence of coherent over incoherent beds, a deep regolith, low shear strength, high plastic index, low liquid limit, high soil activity, the presence of dessication cracks, the presence of permeable over impermeable beds, an abrupt discontinuity between bedrock and overlying regolith, subsurface depressions and drainage lines, and existing landslides.

Tectonism can have a profound effect on landslides, because it is the force that produces absolute relief. It increases the gravitational energy for slope instability and erosion;

if it is severe it causes material to be subjected to the climatic conditions of higher altitudes and changed microclimatic patterns.

Seismicity can have a much greater effect on landslides than any other form of vibration (Crozier, 1986). Even small earthquakes can cause landslides, by imparting a shearing stress to a slope and reducing the resistance of the slope material. Keefer (1984), in his assessment of local magnitudes, found that landslides could be induced by earthquakes with a local Richter magnitude M_L of ≥ 4.0. In the United States, Nilsen and Bubb (1975) claimed that some landslides up to a year after the San Francisco earthquake of 1906 were probably a result of the shock. In Southern Italy, the example of the Calabrian earthquake of 5 to 6 February 1783 shows how an extreme event can cause changes to geomorphology. It led to "numerous huge landslides involving slumps, slides, falls, spontaneous liquefaction phenomena... numerous landslide lakes..." and other phenomena (Cotecchia, Travaglini, and Melidoro, 1969, 2).

Climate can have a significant effect on slope stability. Crozier (1986) showed that the probability of slope instability is increased by: rainstorms, droughts, rapid snowmelt, freeze-thaw cycles, and cyclones. Although climatic factors are most immediately obvious in their contribution to slope instability in acting as triggering factors, they are particularly important in their action as predisposing factors - by influencing the creation of morphogenetic regimes specific to particular climates. The impact of climate is more clearly evident in its influence on exogenic regimes (based on the relationship between climate, vegetation, soils, and topography) that has a significant influence on the response of slopes to environmental fluctuations. The triggering of landslides is particularly dependent on rapid rainfall or snowmelt, which may lead to surcharging and lateral pressures in the soil.

Vegetation is "one of the most influential and sensitive elements of the exogenic system" according to Crozier (1986, 156). Slope instability is increased by the occurrence of: hydrophitic plants, potassium-demanding plants, major changes in the biomass, or (on steep, jointed slopes) high biomass, or (on other slopes) low biomass. The vegetation can be changed by a number of factors (climatic change, disease, fire, synecological competition, or browsing) but the most rapid changes are usually the result of humankind.

Particularly important in this respect, it has been claimed, is deforestation: though as Crozier (1986) explained, research on deforestation may exaggerate its significance:

other factors may influence the data gathered, high-magnitude landslides under forests may go undetected, and vegetation can act to destabilize slopes under some conditions. Nevertheless, on balance deforestation seems to increase landslides: principally by reducing surcharge on the slopes, increasing soil moisture, reducing soil permeability, producing a less equable microclimate, and reducing the mechanical reinforcement of roots.

Humankind has always influenced the environment. At first these influences were no different than those of any other organism - indeed, less significant than many. As humankind has differentiated itself from other animals through the development of culture, it has increasingly influenced the environment through the application of technology (Gutkind, 1956). More specifically, it has increasingly come to manipulate the land through deforestation, agricultural practices, industrialization, and urbanization. The more humankind has come to know about the land, the more has the modification of the environment become a deliberate process.

The human influence on landslides has predominantly worked indirectly, by influencing the evolution of preparatory physical factors - rather than by directly triggering slope movements. The most widespread influence is through controlling vegetation - particularly for agriculture. Construction of roads and buildings is affecting a growing proportion of the land and through engineering programmes, and other forms of intervention such as reforestation, humankind has acted to stabilize slopes (Selby, 1987).

Landslides represent a significant hazard, but past research has differed in the significance given to causative factors. The ways in which the interaction of these factors has been analyzed is dealt with in the next section.

2.4.2 The approaches to landslides

The influence of a wide variety of environmental and social factors on slope instability makes landslides a relatively difficult research topic for either the behaviouralist school or the structuralist school. For the behaviouralists, landslides do not have clearcut physical causes (and their partly-social causes indict the societies which contribute to their existence). For the structuralists, landslides do not have clearcut social causes (and their partly-physical causes excuse the societies which contribute to their existence).

The behaviouralist approach to landslides stresses the significance of their physical causes (Burton, Kates, and White, 1978; Bryant, 1991; K Smith, 1992). It acknowledges that humankind has a role in modifying the environment but, as a result of the retention of the environmental determinists' view that society is essentially reactive to nature, has concentrated on an analysis of the geophysical mechanisms which trigger them - with a view to their monitoring, management, and control.

Also important has been the issue of vulnerability to landslides. The traditional explanation of environmental degradation has been that poor management is the cause of land degradation (Redclift, 1984; Blaikie, 1985). The transition to a modern, urban society has an acknowledged effect on this process - particularly through urbanization and associated rural depopulation.

Since the industrial revolution, humankind has become increasingly affected by environmental hazards such as landslides as a result of the increased demand for resources, an increasing concentration of population, and an increased interdependence of individuals and communities. Not only has humankind exploited more-marginal environments, it has also made those environments more susceptible to landslides - particularly through urbanization and the destruction of natural vegetation. Destruction has been especially severe in poor, developing areas undergoing social transition and integration into the world market. There is disagreement over the significance of this trend: Boserup (1981) argued that rural decline in Africa has hindered stable land management by forcing the adoption of more extensive agricultural systems - though according to Knox (1984) it is essential for modernization and the longterm protection of the land.

The small amount of structuralist research on landslides indicates that humankind's behaviour is of major importance. Social behaviour is mainly shaped by political and economic factors, though is dependent on contingent local factors which include the local structure of society - but also include the nature of the environment on which society works. This is evident in the work of Hewitt (1976) and Jefferey (1981), which shows that development has acted to change radically the use that has been made of the environment (producing more landslides) and has also made society less tolerant of landslides.

Hewitt (1976) looked at the causes of landslides in north Pakistan after the 1974 earthquake. He found that, under the influence of protoindustrialization, local people had carried out an ecological devastation which had profoundly modified those preparatory factors - and made the land more vulnerable to landslides. Although the triggering factor for many landslides was the earthquake, the main reason for those were the preparatory factors of widespread deforestation, overgrazing, and a reduction in concern for the land.

The changing relationship between humankind and landslides was an issue taken up by Jefferey (1981). In Indonesia, landslides have for long been a part of ordinary life for the local people, who had established a balance of tolerance with their "normal landslides". However, the pattern she described in Indonesia was of landslides increasing with development. Perversely, development produced both an antagonistic attitude to the environment and a society which is more reliant on environmental stability.

2.4.3 Landslides in the Mediterranean

Landslides in regions such as Basilicata are influenced by a number of environmental and social factors specifically characteristic of the Mediterranean - most notably its climate, vegetation, and the range of cultural practices that have influenced its landuse.

The Mediterranean's current climatic regimes and exogenic slope regimes, are relatively new. Recent research indicates that the last glacial retreat from Europe occurred about 10,000 BP. The general pattern across Europe since then is reasonably well understood (Barry and Chorley, 1987): a post-glacial climatic maximum was reached about 5000 BP; followed by a decline from about 2000 BP. Around AD 900, the medieval warm epoch set in, until around AD 1300, with temperatures perhaps 0.5 to 0.8° higher than the European average for AD 1900 to AD 1950 (Flohn and Fantechi, 1984). From AD 1300 the weather became noticeably more changeable throughout Europe. The "Little Ice Age" reached its most intense in the period AD 1550 to AD 1700, with temperatures perhaps 0.7 to 0.8° below the European average for 1900 to 1950. From AD 1700 to AD 1730 there was a marked warming. The nineteenth century saw cooler summers, but a consistent warming began at the end of the century which reached its peak between the 1930s and 1950s.

The influence of broad changes in climate on landslides can be seen in the general pattern identified by Starkel (1966) in lowland Western Europe: according to which there have been three main phases of increased landslides linked to pluvials over the past 11,000 years. These were: up until 10,000 BP, from 7000 BP to 6000 BP, and from 2500 BP to 2000 BP. Similarly, in Italy, Flohn and Fantechi (1984) showed that the pattern of floods and wet years in Italy showed high levels between 200 BC and AD 200 (2150 to 1750 BP), and from AD 1000 (950 BP) onwards. They reported that the significant increase in floods in the sixteenth century led to an increase in landslides across the whole of Europe.

There is considerable debate over the significance of climate in environmental change in the Mediterranean. Blaikie and Brookfield (1987) showed that the debate over the causes of change has tended to polarize between environmental determinism, and social voluntarism. The complexity of the available information was reviewed by Roberts (1989). Comparing the data on cultural and environmental change in the Mediterranean he concluded that environmental degradation in the region has a complex variety of causes:

> The fact that alluviation began as early as 3500 yr BP in some areas... suggests that climatic oscillations were unlikely to have been solely responsible. On the other hand it would be wrong to assume that all eroded Mediterranean hillsides are anthropogenic landscapes...
>
> In most cases historical soil erosion was a combined product of natural and cultural forces. [Page 142.]

The supposed importance of climate and climatic change as a major factor in the level of land degradation and landslides can be traced to the climatic-determinist school and has been revived principally by the work of Harris and Vita-Finzi (1968) and Vita-Finzi (1969, 1973, 1976). Harris and Vita-Finzi (1968) claimed to have found trends in erosion across the Mediterranean, and argued that they must be the result of climatic change. Vita-Finzi (1969) noted synchronous cycles of channel erosion at several sites from about 8000 BC to post-Roman times, which was then followed by deposition ("Younger Fill") until recent years. He argued that the synchronicity of Younger Fill implied climatic origins. However, his later work (1973, 1976) led him to suggest that further south these changes occurred earlier.

A number of sources have agreed that climatic change has played the major part in the level of land degradation - implicitly including landsliding. Shaw (1981) concluded from his work in North Africa that climatic change has been responsible for degradation which was only modified by human activity.

In his review of the evidence on land degradation, Davidson (1980) pointed out that the causality of degradation is highly complex and argued that the Mediterranean experienced a much more intricate denudation chronology than Vita-Finzi allowed for - for example, accelerated soil erosion had already affected Santorini by 1470 BC. And Judson (1963) had found two periods of deposition in Sicily (after the eighth century BC to 325 BC, and a medieval phase) separated by an erosion phase. In Etruria he observed one fill period lasting from the late-Roman period to the medieval.

In addition, a range of research has suggested that environmental change cannot be divorced from social changes, and the two have acted together to produce environmental degradation. Particularly influential in this respect has been the contribution of Marsh (1864, 5-7) which acknowledged the importance of the environmental factors predisposing the Mediterranean to change, but stressed the importance of the correlation between social and environmental change:

> The decay of these once flourishing countries is partly due, no doubt, to that class of geological causes, whose action we can neither resist nor guide, and partly also to the direct violence of hostile human force; but it is, in a far greater proportion, either the result of man's disregard of the laws of nature, or an incidental consequence of war, and of civil and ecclesiastical misrule. Next to ignorance of these laws, the primitive source, the *causa causarum*, of the acts and neglects which have blasted with sterility and physical decrepitude the noblest half of the empire of the Caesars, is, first, the brutal and exhausting despotism which Rome herself exercised over her conquered kingdoms, and even more over her Italian territory; then, the host of temporal and spiritual tyrannies which she left as her dying curse to all her wide dominion, and which, in some form of violence or of fraud, still brood over almost every soil subdued by the Roman legions. Man cannot struggle at once against crushing oppression and the destructive forces of inorganic nature. When both are combined against him, he succumbs after a shorter or longer struggle, and the fields he has won from the primeval wood relapse into their original state of wild and luxuriant, but unprofitable forest growth, or fall into that of a dry and barren wilderness.

Several writers have followed this argument that there is a complex interaction between society and the environment - in which both act as agents of change. Braudel (1972-1973) argued that medieval erosion was caused by the inability of agriculture to cope with the climatic changes of the Little Ice Age. Similarly, Naveh and Dan (1973) showed that in Palestine the breakdown of complex agricultural ecosystems was principally the result of social crisis - but noted that "damage was more far-reaching and recovery much slower on the more sensitive natural environments" (page 124). And Hare (1977) concluded that desertification in the Mediterranean was largely the result of "unwise" social adaptation to drought.

However, many have claimed a primacy for human action. Tricart and Cailleux (1972), Büdel (1982), and Blaikie and Brookfield (1987) all pointed out that humankind has significantly altered, and even reversed, "normal" processes in the Mediterranean. Some sources have even argued that some environmental changes have been solely the result of humankind. Murphey (1951) concluded that the breakdown of irrigation works in North Africa was the result of social pressures. Slicher Van Bath (1963) attributed the widespread degradation of the Mediterranean in the early-modern period to breakdown in farming systems due to economic recession. Mikesell (1969) argued that destructive deforestation in the Lebanon caused land degradation there. Van Ziedam (1975) found Younger Fill deposited in Zaragroza from about 700 BC to AD 100, related to human activity. And, working in South-East Spain, A M Harvey (1978) found that the main changes during the Holocene were caused by vegetation and land-use changes.

The Mediterranean's ecosystems are readily susceptible to disruption and degradation. According to Tricart and Cailleux (1972, 244) humankind in the Mediterranean "has, with only a few exceptions, completely modified the morphogenic system of the non-cultivated land". In the Mediterranean, according to Büdel (1982, 324), "anthropogenic effects on the soil and relief play a greater role... than in nearly any other climatic zone". "Normal" geomorphological processes have been so greatly changed by humankind that geomorphological processes have altered and the land has become a social product - it has been "humanized".

The destruction of much of the climax vegetation has increased erosion significantly because when the plant cover is reduced, the level of soil nutrients and fertility fall, bare patches develop on the soil, accelerating mechanical erosion, the soil loses cohesion, and at the same time the less cohesive B and C horizons will be exposed (as a result the re-establishment of vegetation becomes more difficult as erosion proceeds). This may be followed by sheetwash and gulleying.

In areas with similar exogenic regimes to those found in Basilicata, vegetation has a significant influence on landslides. Sala and Adolfo (1990) described how the nature of litter and the root-binding characteristics of vegetation can markedly affect landslides. Cooke (1984) showed that in the Bell Canyon watersheds of California, the areas most prone to instability were those with a low vegetation cover: while only a small proportion of woodland was affected by landslides (1.2% of broadleaf chapparal, 2.6% of oak chapparal, 3.3% of chamise chapparal, and 5.3% of riparian woodland) but a much higher proportion of the area under other types of vegetation was affected (6.5% of annual grass, 11.9% of perennial grass, and 23.9% of sage and barren).

Humankind has modified the Mediterranean's vegetation since the late Pleistocene, when hunter-gatherers began to use fire to replace the dense forest with more open woodland and grassland (Simmons, 1989). According to Delano Smith (1979) pre-neolithic peoples probably had a relatively limited impact on the land compared to the agriculturalists who replaced them. The pre-classical introduction of agriculture into the Mediterranean began a long period of deforestation with profound environmental effects (Morandini, 1977). Delano Smith (1979, 293) described the environmental effects of traditional methods of deforestation in Southern Europe as follows:

> The herbaceous layer is removed entirely, shrubs are uprooted and canopies lopped from the very big trees. Trunks and stumps are left in the ground to rot. After clearance comes years of cultivation... Crops do afford some sort of protection but this is by no means as effective as the original vegetation. Cropping is seasonal and during the months of immaturity the plants cover only a small part of the soil. Then the soil is left bare, as fallow until a weed cover develops, scarcely adequate as a protection against erosion even after a year or two.

The extent of deforestation can be gauged by Glesinger's estimate (1960) that in 1960, forests occupied 18 million hectares in the Mediterranean, contrasted to the climax figure of between 100 million and 200 million hectares. Tomaselli (1977) identified three major phases of deforestation in the Mediterranean resulting from colonialism and from commercial pressures divorced from the productive capacity of the environment. The first was during the Roman Empire, the second during the period of medieval pastoral agriculture, and the third was from about AD 1500 onwards with the development first of mercantilism and later industrialization.

The cultural attitudes to the land have also had a profound impact on the mediterranean environment. Judeo-Christian culture has a tradition of living with disasters: and even now, according to Fabbri (1982, 39, translated) there remains a folk belief that "calamitous or catastrophic events are inevitable". Passive acceptance of hurt as inevitable and "natural" is a widespread strategy for coping with hazards by individuals or groups who lack or have lost the power to control their own lives (see N Smith, 1990).

This fatalism was tempered by a faith in the protective power of religion and magic. The outside world was perceived to be in the control of powerful supernatural forces and the supernatural to give some hope of protection against the threatening world. Following Gutkind (1956, 12) the approach to the land in the Mediterranean can be seen as characterized by a change from a "hesitant and whispered dialogue between man and nature" to an "aggressive and loud exploitation". The change can be seen in the history of the struggle against landslides - a history which has been conditioned by the institutions and practices developed to manage the land.

Although the very earliest societies had the ability to modify the environment, this ability was rarely exploited. The roots of the inaction lie partly in social and technological impotence, but also in the ideology of an eternal, dominating nature (N Smith, 1990). This approach has continued in the popular consciousness in the rural Mediterranean until the recent past.

As Gutkind (1956) showed, the modern approach to the land and its hazards is very different. It aims to apply science in order to manage hazards and is characterized by the application of a range of techniques formed and constrained by the bureaucratic ethos which generated them (Hewitt, 1983). The sporadic nature of the bureaucratic response to landslides makes an inappropriate and inadequate allocation of resources unavoidable. For example, Griggs and Gilchrist (1983) commented that throughout the world many areas only use planning mechanisms for reducing the risk from landslides after a major landslide has aroused public opinion.

Although they may still be harmed by hazards, communities can benefit perversely from the bureaucratic response to disasters - because of a combination of an injection of outside aid, the beneficial effects to the local economy of the work of reconstruction, and possibly the opportunity to modernize the infrastructure of society (Dacy and Kunreuther, 1969; Friesma and others, 1979). Geipel (1982) claimed that damage after the earthquake of 1976 in Friuli, Northern Italy was exaggerated by local politicians, and that the aid which followed the earthquake had a generally beneficial effect on the local economy.

Having evolved policies to manage hazards and the funds which are available to cope with them, bureaucratic administrators in countries such as Italy have a vested interest that the hazard should continue. It provides work, it provides money, and it provides prestige for the bureaucracy. Consequently, although intervention after the event is usually more costly, and anathema to recognized good management practice

(Koontz and Weinrich, 1988) yet it may satisfy the administrators' direct electoral need for drama.

The result of the bureaucratization of hazards is a reliance on the state and its agencies for protection against hazards. The state's response to landslides is shared with local government (also known as the "local state") which operates "those aspects of state policy that the central government considers should be administered within sub-areas of the national territory" (Johnston, 1985, 154-155). The way these parts of the state attempt to manage hazards is the result of compromise between the political society and civil society. According to neo-marxist analysis this compromise is structured by the functional requirements of capitalism (Urry, 1981; Johnston, 1989). Most important in this respect is the state's need to legitimize itself through organizing hegemonic consent for its actions.

Yet since the state embodies powerful class interests, its involvement in hazards creates the paradox identified by the Frankfurt School that technology may bring greater freedom from nature (N Smith, 1990) - but this is at the expence of conceeding freedom to powerful organizations and institutions. As Atkinson (1991) showed, the theme that the application of technology inevitably leads to a reduction in personal freedom has been analysed by a number of radical environmentalist writers. Particularly interesting in this respect was Gorz (1980, 60): "for the satisfaction of *all* needs a person is first of all reduced to dependence on giant institutions and tools that are out of the individual's control and grasp... a person depends on the *mega-tools* of bureaucratic and commercial *mega-institutions* and is reduced to only being their client - submissive, standardized, powerless, exploited, and always dissatisfied."

Physical and social structuration factors have acted together in the Mediterranean to produce the pattern of landslides investigated in the remainder of this dissertation. These structuration factors are modified locally by the geographically-specific combination of factors that occurs in each locality and produces contingent triggering factors which are responsible for each incidence of landsliding. Some idea of the processes affecting regions such as Basilicata can be seen in Cooke (1984, 3) which described the situation in Los Angeles County, a climatic analogue for Basilicata:

> The stage upon which the processes play is largely predetermined by topography and the pattern of drainage, the underlying geology and soils, the vegetation cover, and the external climatic forces... But fundamental to an understanding of geomorphological activity in the Los Angeles region is the fact that some of the predetermining condition and the geomorphological processes themselves are not constant: they evolve as a result of the changes in, for instance, the location, frequency, magnitude and duration of storms, tectonic activity and fire, the

> transformation of surface characteristics by the processes of urbanization, and hazard management...

The pattern of landslides produced in Basilicata is investigated in chapter three, and the role of the causative factors specific to the region is investigated in chapter four.

2.5 Conclusions

This chapter has shown how hazards provide a salient reminder that humankind cannot dominate the environment. It has also shown that the appreciation of this reminder has been profoundly influenced by the ideological implications present in the paradigms on environmental hazards. The study of hazards first flourished under behaviouralist research, which concluded that humankind is essentially reactive to hazards, but can use technology as a cure. More recently, structuralist research has implied that humankind's relationship with hazards is much more ambiguous, and that the political and economic structure of society influences hazards.

The structuralist approach provides a major challenge in hazards research: not just to the theoretical understanding of hazards, but to the very practical treatment of them: how much blame has society for the hazards that people experience, and how might that blame be reduced? It is evident that the structuralist critique of environmental hazards makes a reassessment of landslides necessary. In this assessment the knowledge and insight gained in research carried out under other paradigms should be criticized, but not rejected out of hand as irrelevant or misleading - the already-quoted suggestion by Hewitt (1983, 25) that "in isolation... our emphases would also add up to an unbalanced view" shows that he himself was of this opinion.

Indeed, there are some important points of concensus. Although the misleading term "natural hazards" continues to be used (for example even in the title of Bryant's *Natural Hazards*) there is now a general concensus that society often has a profound influence on the occurrence, form, and magnitude of hazards. The impact of all environmental hazards is influenced by the nature of society, and the majority of hazards - including landslides - are at least in part influenced by humankind. However, the influence of causative factors in the contingent circumstances which produce each individual hazard varies greatly, and many landslides occur without any human involvement.

Although most of the literature on political economy and on environmental hazards continues to be separate, some work has bridged the gap between the two - most notably, for the purposes of this discussion, Cooke (1984) and Crozier (1986). These two works draw not just on the insights of structuralist analysis (in Crozier's case the use of structuralist sources is made quite explicitly) but also on the long tradition of research into environmental change which acknowledges the complex interaction of humankind and the environment. However, to accept that some elements of concensus exist should not be taken to imply that its components are of equal worth. This dissertation is designed to help in identifying the valuable research findings, by assessing the relative merits of the two main competing paradigms for explaining landslides in Basilicata.

The assessment of society's role in environmental hazards which this dissertation's approach allows is of crucial importance for the future use of the environment: if society has no significant role in environmental hazards, the behaviouralist approach to hazards (and the liberal-technocratic approach to the environment) is vindicated. The implication is that society can use technology as a cure for hazards and as a tool for freedom. If, however, society has a major role in environmental hazards, then it is the structuralist approach to hazards (and the radical approach to the environment) that is vindicated. The implication would be that society may continue to use technology to protect itself from hazards, but only as a remedy - not as a cure. Any real cure would have to come through fundamental social change which would allow a fundamental change in the relationship between humankind and the environment.

To test for validity of the insights into environmental hazards requires a research question, which will provide the dissertation's theme, that must be constructed to allow a critical examination of the differing approaches to hazards. This core is the role of humankind: and this dissertation consequently examines the question: *how has humankind increased the intensity of the hazard from landslides in Basilicata, and why has this increase been caused?* Such an assessment is of fundamental importance if the landslide hazard in areas such as Basilicata is to be tackled effectively in the future, and is made in the dissertation's conclusion in chapter eight.

Chapter 3: Landslides in Basilicata

This chapter examines the literature on landslides in Basilicata, and the damage they cause. By comparing several sources it assesses the intensity of urban landsliding during the twentieth century and examines the hypothesis that the level of landslides has not changed significantly over the past two centuries.

3.1 The current pattern of landslides

There is a very large contemporary literature on landslides in Basilicata. In its bibliography on landslides in the region, Regione Basilicata (1987) listed 125 items - of which 55 were published texts and 70 unpublished. Most importantly, there have been three main overviews of landslides in the region, produced by Almagià (1910), Ministero dei Lavori Pubblici (1964), and *Il dissesto idrogeologico della Basilicata* (1984). These regional reports have concentrated on the more significant landslides only. More intensive research has uncovered a much larger number of smaller landslides. In a 2,906 ha sample area in the municipality of Tricarico, for example, Alexander (1991) found 117 landslides with a mean size of 1.675 ha (covering 6.7% of the area), and 42 gulley and rill systems with a mean size of 2.171 ha (covering 3.1% of the area).

The regional reviews have shown a widespread problem: it is especially intense in many of the urban areas, such as the town of Grassano which is taken as a case-study in chapters five to seven of the dissertation.

• Almagià (1910): showed landslides to be widespread in the region. On the subject of urban landslides he noted (on page 395) that 94 of the 124 municipalities then in existence were affected by landslides or the threat of them. However, some doubts must exist as his accompanying map showed 129 of today's 131 municipalities, of which only 73 were shown as affected by landslides or the threat of them (figures 3.1 and 3.2).

• Ministero dei Lavori Pubblici (1964): recorded 158 major landslides in the region, and that 104 municipalities were threatened by landslides.

Figure 3.1 Basilicata: settlements

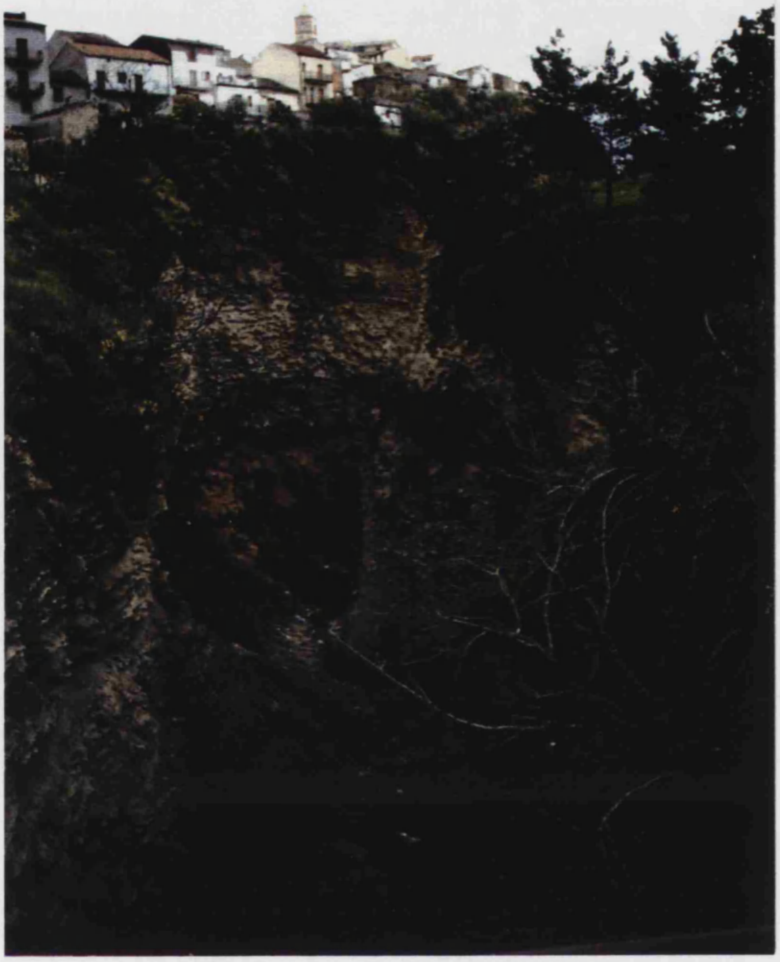

Figure 3.2: Oliveto Lucano

• *Il dissesto idrogeologico della Basilicata* (1984): showed that superficial slope instability affects 18.4% of Basilicata's 9,992 km^2, with deep landslides covering another 2.6% of the region. Approximately 6,300 sites of superficial erosion phenomena, surface landslides, or solifluction were noted which together covered 184,000 ha of the region. There were approximately 1,800 deep landslides, covering a total of 25,800 ha; and 1,000 km of the drainage network was affected by severe erosion processes. The proportion of the region affected by various types of slope instability is given in table 3.1.

Table 3.1: Basilicata: proportion of the land affected by slope instability (source: *Il dissesto idrogeologico della Basilicata,* 1984)

Shallow processes:	
sheet erosion	3.6%
rill erosion	5.5%
calanchi erosion*	1.5%
debris flow/solifluction	7.7%
Deep processes:	
lateral spread	0.92%
rotational slide	0.62%
translational slide	0.02%
rockfall	0.15%
complex landslide	0.80%

The data in *Il dissesto idrogeologico della Basilicata* (1984) is very detailed, and is designed to satisfy requirements for geotechnical information across the region. Consequently, in order to allow a simplified, accessible mapping of the region's

* Calanchi is a form of badlands experiencing intense erosion combined with superficial landsliding. Calanchi has been defined as "heavily dissected terrain with steep, bare slopes and channels which rapidly incise and extend headwards, but which are frequently obliterated by mass-movement debris. They... are especially common on the Plio-Pleistocene marine clays of the Calabrian deposits." (Alexander, 1982b, 71.)

Calanchi is often initiated by shallow landslides breaking up the regolith and its morphology is derived specifically from the behaviour of cohesive sediments: "Calanchi erosion involves a relationship between mass movement and the incision of channels, and morphological variations are complicated by the presence of pipes, which may be vertical or inclined, and which provide an alternative to surface drainage." (Ibid, 85.)

landslides, landslide-inventory maps were constructed based on the approaches outlined in Griggs and Gilchrist (1983), Hansen (1984b), and Cooke and Doornkamp (1990).

For the inventory maps the region was divided into a grid of cells, 2' longitude by 2' latitude, which was superimposed on the 1:100,000 slope-instability map in *Il dissesto idrogeologico della Basilicata* (see Appendix A). Any gridcell half or more covering land was counted. There are 953 gridcells in all, giving a total surface equivalent of 9,911 km^2, assuming a mean size of 10.4 km^2 - acceptably close to the region's 9,992 km^2 area. The longitude-latitude base of the grid has the minor disadvantage that, as the circumference of the earth varies with latitude, the distance subtended by 2' of latitude is less at 41°08' N (the north of Basilicata) than it is at 39°54' N (the south). However, the difference at its maximum is proportional to the ratio between the sines of 50°06' to 48°52' - which amounts to an insignificant 1.9%.

Two classes of instability were analyzed, following the divisions made in *Il dissesto idrogeologico della Basilicata* (1984): superficial instability (sheet erosion, rill erosion, calanchi erosion, and debris flow and solifluction) and deep slope instability (lateral spread, rotational slide, translational slide, rockfall, and complex landslides). The percentage of each gridcells covered by a given type of slope instability was measured by constructing a rectangular grid, composed of 100 subunits of equal size, that was printed onto an acetate sheet and superimposed over each gridcell. For each subunit that the instability half-or-more covered, 1% coverage was recorded. The full results are given in appendix A.

To allow the chloropleth mapping of the distribution of instability, the data for all gridcells 1% or more affected by instability was divided into quartiles and plotted in figure 3.3 (for superficial instability) and figure 3.4 (for deep instability) - the areas of very highest instability were specially indicated. Data on the distribution of the instability scores is given in table 3.2 and shows a marked difference in the coverage of slope instability: 80.1% of gridcells were affected by superficial instability, 41.6% of gridcells were affected by deep slope instability. In addition there was a significant negative correlation between the two categories: for the 350 gridcells (36.7% of the total) affected by both superficial and deep instability, the Rho when corrected for ties was -0.176 (significant for a two-tailed test at 0.001) because active superficial slope instability hinders the development of deep regolith which tends to promote landslides (see Crozier, 1986).

Figure 3.3 Basilicata: superficial instability

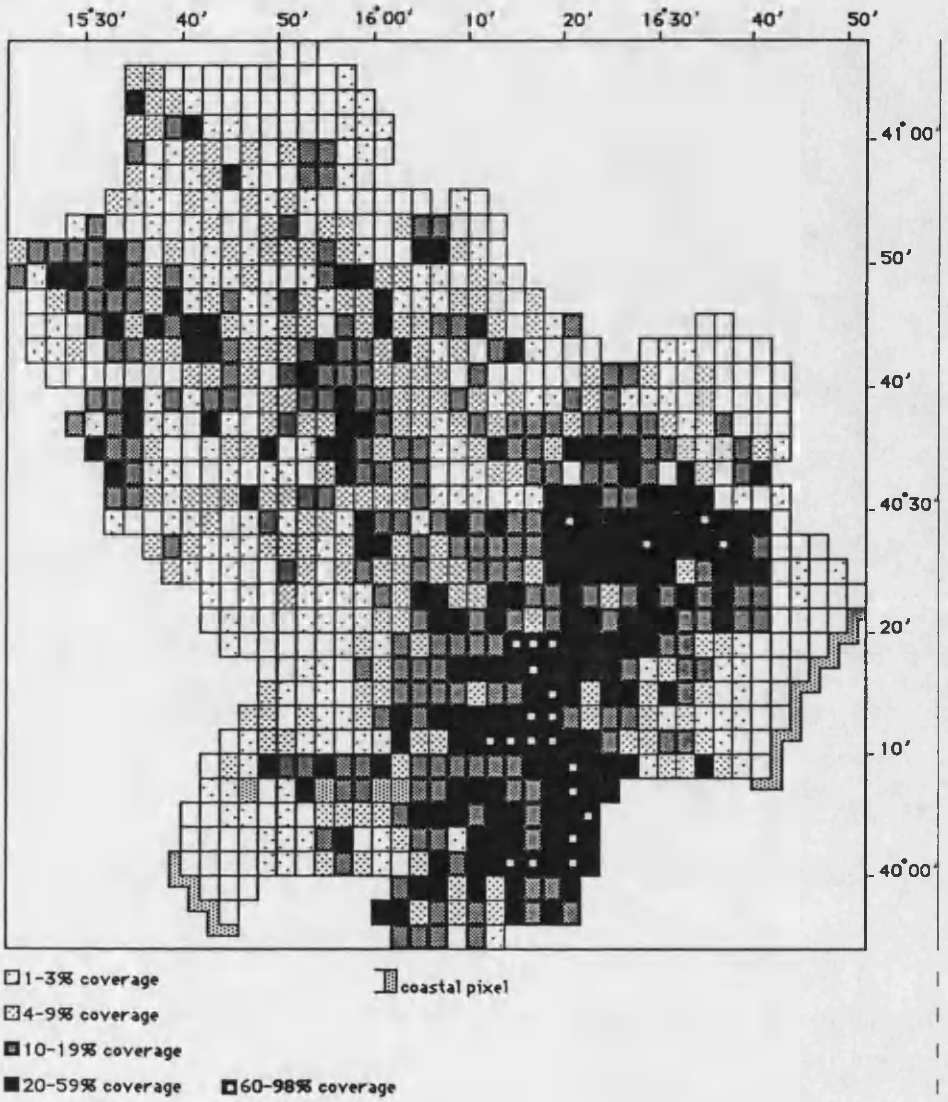

Figure 3.4 Basilicata: deep instability

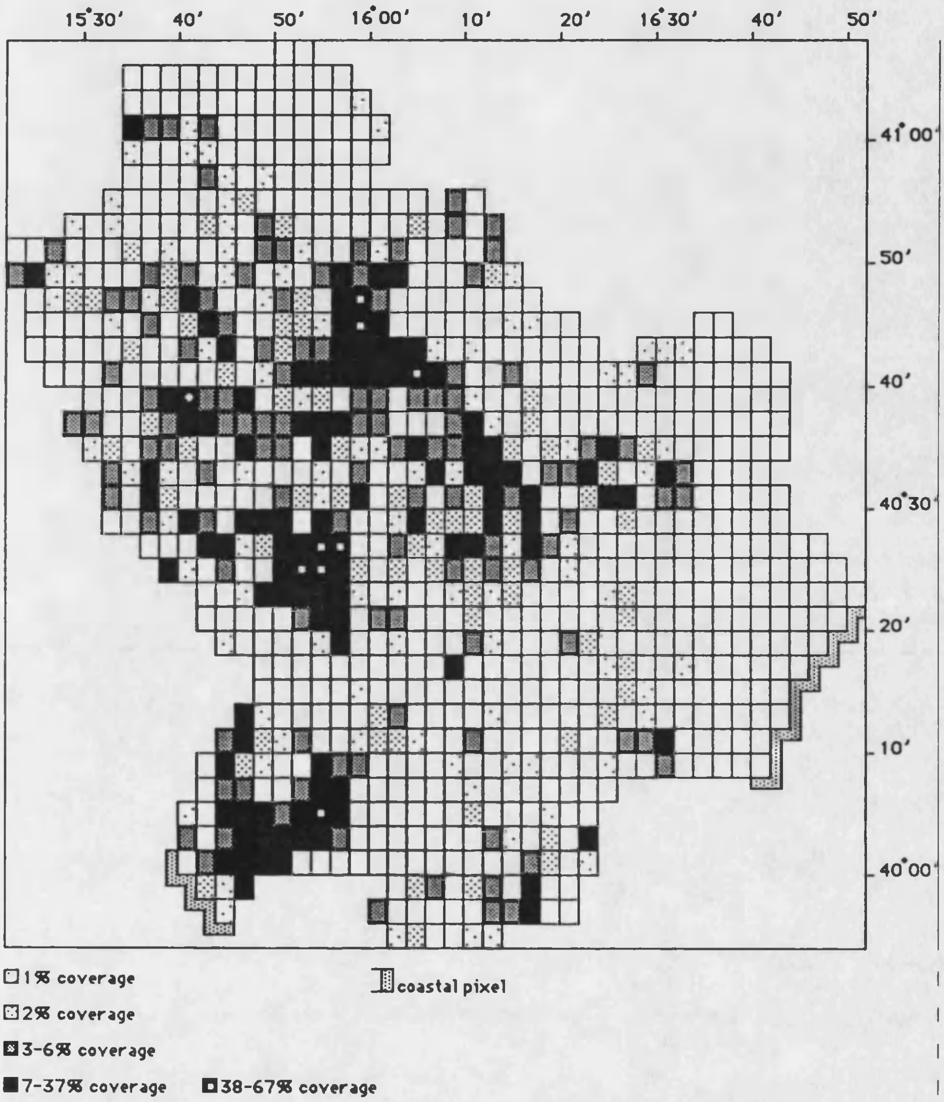

Table 3.2: Landslide-inventory maps: superficial and deep instability (full data given in appendix A)

	Count	*Missing*	*Mean*	*Standard deviation*	*Kurtosis*	*Skewness*
Shallow:	763	190	15.558	16.733	5.569	2.163
Deep	396	557	7.053	9.978	9.668	2.887

The distribution of the classes of slope instability showed marked differences, and noticeable correlations to the region's geology (figures 4.1 and 4.3). Superficial slope instability affects almost all parts of Basilicata but is mainly concentrated in the area which would be contained between two o'clock and six o'clock were a clockface to be superimposed on the centre of the region. It is particularly associated with steep slopes on deforested clay and conglomerate deposits. Landslides are concentrated in the area between seven o'clock and eleven o'clock, mainly in the geologically-vulnerable schists and sandstones of the Apennines, and the area of most intense precipitation in the Apennines inland from the Tyrrhenian coast.

The maps produced can be compared to the qualitative assessment of landslides in the region produced by Neboit-Giulhot (1990) (figure 3.5). He distinguished between the Apennine landslides (influenced mainly by lithology) and the Bradano Trough landslides (influenced mainly by morphology). He identified three main areas in which the Apennine landslides are concentrated: First, in the southwest of the region around Monte Sirino - where landslides affect mainly the schists and the steep relief and high precipitation are contributing factors. Second, to the south of Potenza - where landslides affect mainly the schists and flyschs. Third, northeast of Potenza - where landslides affect mainly the flyschs and clays. In the Bradano Trough the landslides are particularly associated with steep slopes.

Regione Basilicata (1987) showed that Basilicata has a severe urban landslide problem, particularly in the Bradano Trough. By the 1980s landslides had damaged 106 (81%) of the towns in the region (figure 3.6) - of which 56 towns (43%) were damaged in the decade 1977 to 1987. In 1987 a total of 26 towns (20%) reported urban expansion hindered by landslides and almost 10% of the population was estimated to live in accommodation seriously damaged by landslides.

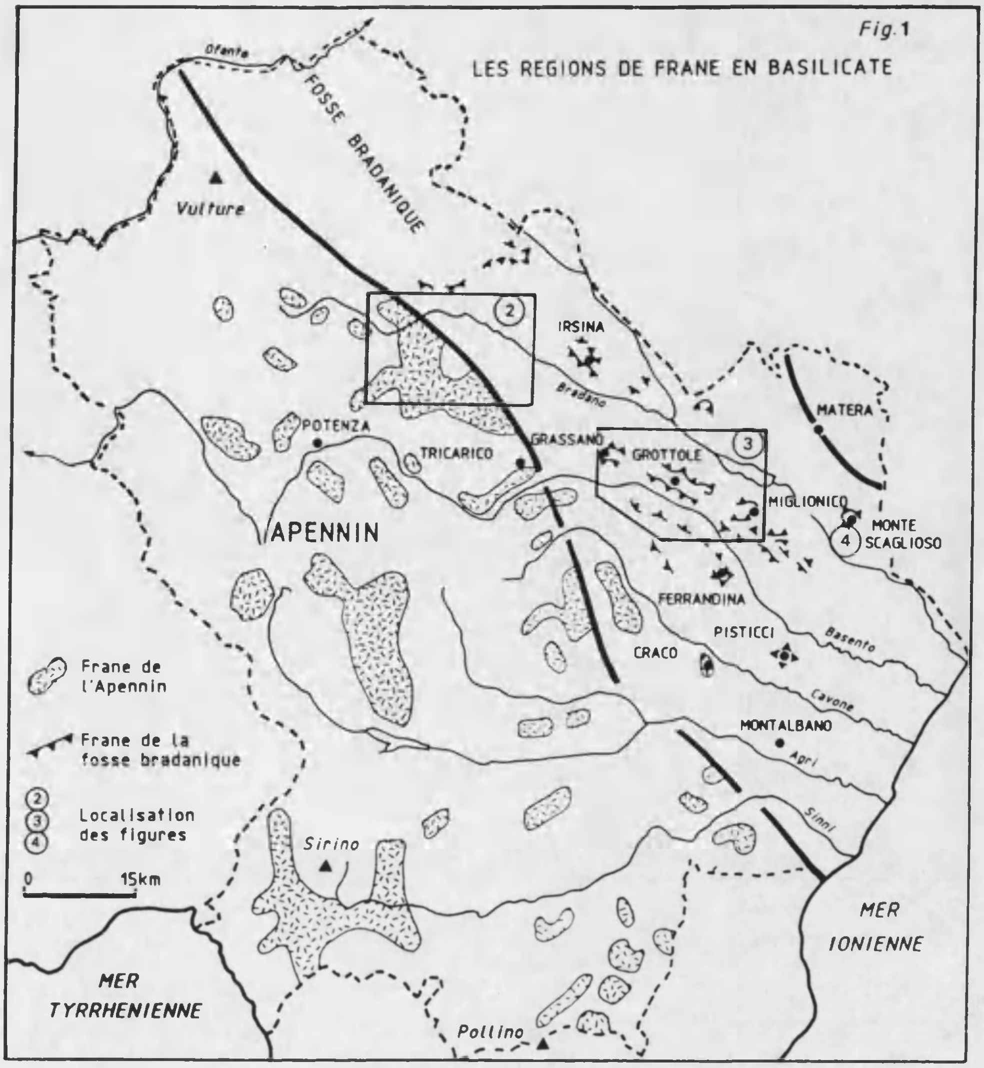

Figure 3.5: Basilicata: landslides (source: Neboit-Guilhot, 1990)

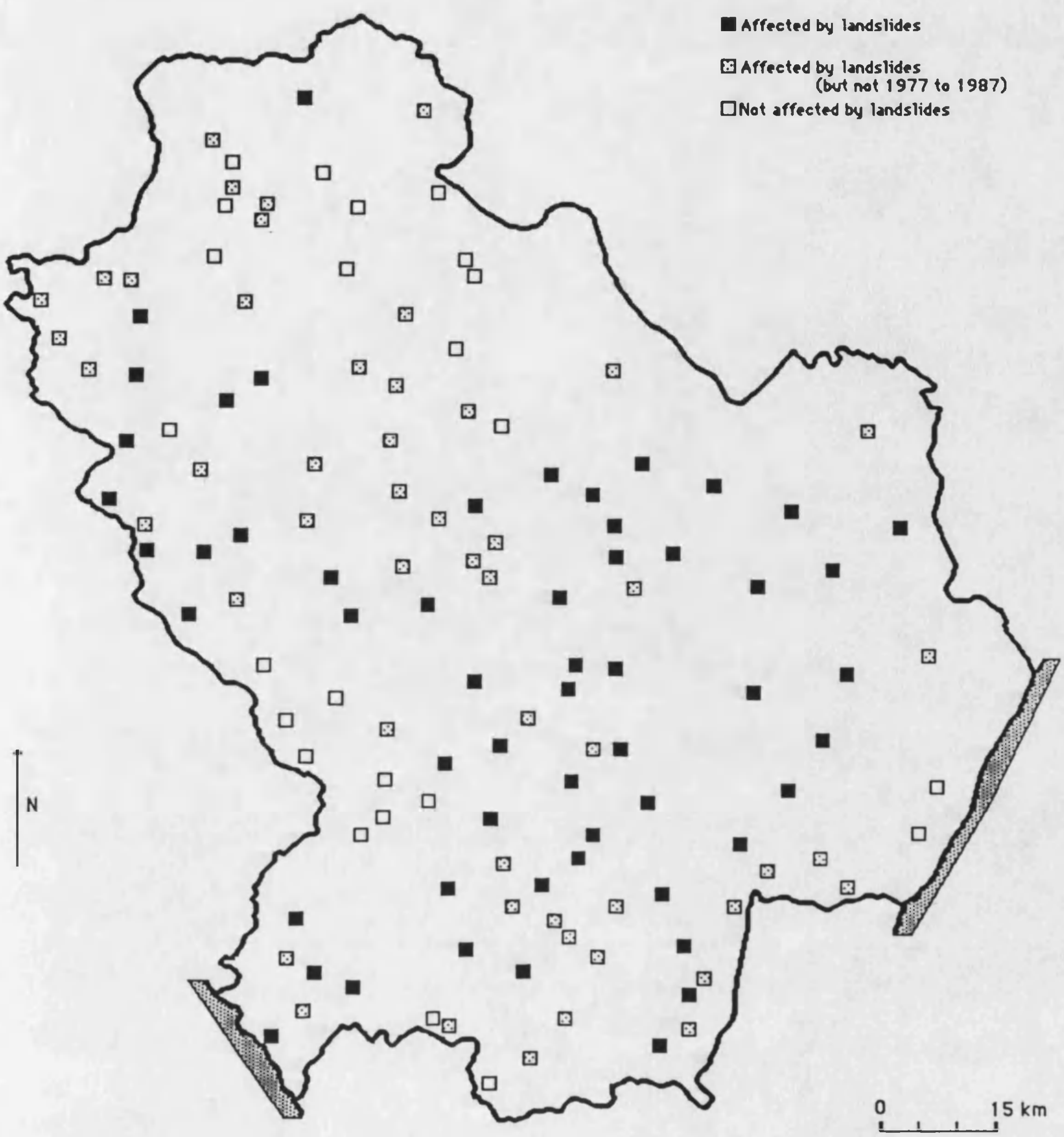

Figure 3.6 Basilicata: urban landslides (sources: Regione Basilicata, 1987; Lazzari, 1986b)

A clearer understanding of the hazard from urban landslides can be gained from Regione Basilicata's (1987) analysis of the landslide problem affecting thirty-seven of the municipalities which the Basilicata regional government investigated in the 1980s. The data is presented in table 3.3 with the municipality's population in 1981, the grade of the landslide hazard as reported in Lazzari (1986b* *), and the date (if any) that orders had been made by central government to consolidate the town against landslides.

3.2 Historical trends in landsliding

The analysis of the historical trends in Basilicata's landslides requires very careful interpretation. Insufficient research has previously been carried out on the dating of landslides to allow generally valid conclusions to be drawn on trends across the whole region. However, the ability of humankind to promote rapid changes in landsliding is well documented, and the results of geomorphological process studies, outlined in the next chapter, provide evidence that the recorded changes in the use of the land in Basilicata have modified many of the preparatory physical factors for landslides. In addition a comparison between primary evidence from the beginning of the twentieth century and published data from the 1980s points to the conclusion that there has been a change in the reported rate of landsliding. This change has been so rapid that, if genuine, it could not be accounted for by endogenous environmental changes and could only have occurred as a result of rapid social changes affecting the land.

The documents available refers principally to the recorded state of the land. This is not adequate on its own because evidence on environmental hazards is subject to manipulation by the cultural media through which it is passed (Guidoboni, 1987). In particular, as was demonstrated by Burton, Kates, and White (1978), and Redclift (1987), technocratic societies such as industrial capitalism are much more aware of the danger posed by environmental problems than were their predecessors. Consequently an increase in reports of an environmental hazard does not necessarily mean that the environment is becoming more hazardous, and may merely represent an increased perception of hazardousness.

* * According to Lazzari's scoring system, "five" indicates the highest level of damage: 1 = "stable", 2 = "limited landslides", 3 = "localized landslides", 4 = "significant landslides", 5 = "very widespread landslides".

Table 3.3: Basilicata: selected urban landslides (source: Regione Basilicata, 1987)

• Accettura (population 2,672; landslide hazard grade 4; consolidation order made 1904): affected by a number of landslides, particularly in the south, east, and new sections of the town.

• Aliano (population 1,706; landslide hazard grade 5; consolidation order made 1904): much of the town - including areas of new towns - is affected by very serious landsliding, which cannot be contained by consolidation works.

• Armento (population 1,137; landslide hazard grade 4; consolidation order made 1904): the eastern part of the town is the worst affected by landslides, with some buildings damaged, and a number under threat. Gulley erosion is causing persistent landslides.

• Avigliano (population 1,392; landslide hazard grade 4; consolidation order made 1904): some widespread landsliding partly caused by remobilized paleoslides and poor foundations.

• Balvano (population 2,286; landslide hazard grade 3; consolidation order made 1904): parts of the town have been abandoned, and a large number of households are homeless.

• Calvera (population 855; landslide hazard grade 3; consolidation order made 1904): severely affected by landslides since the nineteenth century. Some of the landslides cannot be contained by engineering works.

• Castelsaraceno (population 2,086; landslide hazard grade 4; consolidation order made 1904): landslides affect all parts of the town; some evacuations have been carried out, but not all the landslides can be contained.

• Castronuovo di Sant'Andrea (population 1,788; landslide hazard grade 4; consolidation order made 1904): affected since the first decade of the present century by frequent and serious landslides. The landslides cannot be contained.

• Cirigliano (population 657; landslide hazard grade 4; consolidation order made 1904): serious landsliding affects the east of the town.

• Colobraro (population 2,049; landslide hazard grade 4; consolidation order made 1904): surrounded by landslides, which cannot be constrained by consolidation works.

• Corleto Perticara (population 3,668; landslide hazard grade 4; consolidation order made 1904): the outskirts of the entire town is affected by landsliding, and the south of the town is threatened by a paleoslide remobilized by recent construction.

• Ferrandina (population 9,157; landslide hazard grade 4; consolidation order made 1904): gulleying has led to a number of landslides, particularly affecting the southeast of the town.

• Gorgoglione (population 1,456; landslide hazard grade 4; consolidation order made 1904): a number of landslides affect the town.

• Grassano (population 6,261; landslide hazard grade 4; consolidation order made 1904): landslides affect the centre, south, and southeast of the town, with partial transfer suggested.

• Grottole (population 3,163; landslide hazard grade 4; consolidation order made 1904): landslides affect the western edge of the town.

• Latronico (population 5,776; landslide hazard grade 4; consolidation order made 1904): the northeast section of the town is seriously threatened by a landslide, with frequent damage done to buildings.

• Lauria (population 13,477; landslide hazard grade 4; consolidation order made 1904): some districts of the town - particularly the new part of the upper town and the entire lower town are severely threatened by serious landslides which will be very difficult to contain.

• Lavello (population 13,087; landslide hazard grade 1; consolidation order made 1904 and reordered 1935): affected by severe landslides, with widespread evacuations and a partial transfer of a section of the town.

• Maratea (population 5,090; landslide hazard grade 4; consolidation order made 1954): affected by a large sackung and smaller landslides, with a large part of the town left in a precarious situation.

• Misanello (population 848; landslide hazard grade 2; consolidation order made 1904): a large part of the town, particularly its eastern sector, is affected by landslides.

• Montalbano Jonico (population 9,041; landslide hazard grade 4; consolidation order made 1904): gulleying has led to a number of landslides, and the south and southeast of the town is particularly at risk.

• Nemoli (population 1,559; landslide hazard grade 4; consolidation order made 1904): the future existence of the town is threatened, with landslides damaging its eastern, southern, and western edges.

• Noepoli (population 1,589; landslide hazard grade 4; consolidation order made 1908): the town centre is under threat, as is the northeast of the town. Social housing in the town is built on a landslide terrace.

• Oppido Lucano (population 4,080; landslide hazard grade 1; consolidation order made 1904): cellars underneath the town are prone to collapse. A number of homes have been abandoned due to a landslide.

• Pisticci (population 17,685; landslide hazard grade 5; consolidation order made 1904): a long history of landslides. Transfer of the town has been proposed.

• Pomarico (population 5,019; landslide hazard grade 4; consolidation order made 1904 and reordered 1935): large landslides threaten the town.

• Roccanova (population 2,092; landslide hazard grade 3; consolidation order made 1904): there are frequent landslides affecting the outskirts of the town. The southwest section of the town is particularly heavily damaged by landslides.

• San Fele (population 5,924; landslide hazard grade 4; consolidation order made 1904): subject to instability in a number of places, and in urgent need of consolidation. A serious landslide, last triggered in 1968, continues to give cause for concern.

• San Paulo Albanese (population 624; landslide hazard grade 3; consolidation order made 1956): affected by a number of landslides - particularly in the northeast section of the town.

• Satriano di Lucania (population 2,113; landslide hazard grade 3; consolidation order made 1904): a large number of dwellings damaged by landslides.

• Sant'Angelo le Fratte (population 1,630; landslide hazard grade 4; consolidation order made 1904): a number of studies since the beginning of the present century have suggested that the settlement should be transferred because of landslides, but little has been done.

• Sant'Arcangelo (population 6,704; landslide hazard grade 4; consolidation order made 1904): very serious landslides, with partial transfer of the town suggested. Consolidation works have had only a limited success.

• Stigliano (population 7,267; landslide hazard grade 3; consolidation order made 1904): a number of serious landslides affect the town, and consolidation is urgently needed.

• Terranova di Pollino (population 2,016; landslide hazard grade 4; consolidation order made 1904): threatened by a number of landslides. The partial transfer of the settlement has been suggested.

• Tito (population 4,834; landslide hazard grade 3; consolidation order made 1904): threatened by a number of landslides, including some caused by recent urban development.

• Tricarico (population 7,223; landslide hazard grade 3; consolidation order made 1908): landslides affect the east and centre of the town.

• Tursi (population 6,072; landslide hazard grade 4; consolidation order made 1904): gulley erosion, aggravated by the collapse of cellars, has led to quite extensive damage.

- -

There is a range of very well established physical reasons why the environment of Italy, and Basilicata in particular, has long been susceptible to landslides. However, environmental degradation has only been recorded as a problem in Italy since the seventeenth century (according to Burato, 1976) or the eighteenth century (according to Delano Smith, 1979). Before that period, evidence of environmental degradation was suppressed or ignored: Pedio (1964) suggested this may have been because it was irrelevant to the needs of the feudal landowning class. Vita-Finzi (1969, 39), following Marsh, remarked on the well documented reports of degradation in parts of Italy since the Classical period.

> Rivers that were navigable in Classical times, and in some cases as late as the sixteenth century, have silted up. The course of lowland streams has altered and continues to do so. Former ports - notably Ostia - now lie inland as a result of deposition at their mouths. Indeed, many Italian deltas have formed almost entirely in historical times, although at varying rates...

Similar changes have been noted in Basilicata, where landslides have long been facts of everyday life, and Zanardelli (cited in Corti, 1976, ix, translated) described conditions in the region as "in contrast to its ancient flourishing state". By the end of eighteenth century there had already been considerable evidence of landslides in the region - with reports from Pisticci in 1505 and 1555 (Guericchio and Melidoro, 1979) and from Stigliano in 1697 (Boenzi, 1974). At Pisticci, in 1688, a landslide killed several hundred (Almagià, 1910; Guericchio and Melidoro, 1979), and in the seventeenth century, the town of Oggiano - near present-day Ferrandina - was destroyed by landslides (Camera dei Deputati, 1954; Sebastiani and Sebastiani, 1979). According to Alexander (1989b, 229), many such settlements in Southern Italy "have successfully absorbed small disaster events from previous epochs, including landslides, minor earthquake damage, urban karstic subsidence, or the depradations of gully erosion at their peripheries".

A number of sources show an increase in the level of reported landslides in Basilicata before the twentieth century. Almagià (1910) listed 287 landslides in Central and Southern Italy which had occurred between AD 1103 to AD 1908. Of these, 69 were in Basilicata - the earliest recorded at Pisticci in 1698, with one further example reported for the seventeenth century, one in the eighteenth century, thirty-eight in the nineteenth century, and twenty-nine between 1900 and 1908.

From the eighteenth century a number of writers recorded the problem of land degradation and landslides, and pressed for soil conservation as a necessary condition for revitalizing the region - quite possibly in reaction to a worsening of land degradation (Boenzi, 1974). Afan de Rivera (1832) and Monticelli (1841) described the problem from land degradation in the Kingdom of Naples and stressed the economic importance of land reclamation. D'Errico (1846) drew attention to the hazard of urban landslides in Basilicata - which threatened damage to many towns and even destruction of some.

Documentary evidence on the number of landslides across the region implies that the hazard from landslides has reached historically-unprecedented levels in the twentieth century, and is continuing to intensify. The reported number of landslides in the region increased, but the reporting of them undoubtedly became more assiduous as a result of the developing ethic of managerialism. The rising concern over environmental degradation and landslides in Basilicata has been reflected in the growing documentation and analysis of them. This led to a growth in official concern over the problem during the late nineteenth century which culminated in the tour of Basilicata made by the President of the Council of Ministers, Zanardelli, in 1904 (Corti, 1976). He found a widespread problem of intense erosion, with landslides common along the banks of the larger rivers and the gulleys.

As a result of Zanardelli's report, and the shock which it provoked among the political classes, two laws were passed to allow government funding of consolidation against landslides, law 130 of 1904 and law 445 of 1908. Given the cautious nature of bureaucratic innovation, the large number of towns scheduled for consolidation by the government shows both the widespread existence of urban landslides at the time, and the real fear which they engendered. The distribution of these towns is shown in figure 3.7.

A second source on the intensity of landsliding at the beginning of the twentieth century is an early official inventory of urban landslides. On 3 January 1906, a landslide at Genzano di Lucania caused the death of fifteen people. Requests were made for national assistance, and the Ministero della Real Casa wrote to the prefect requesting information on his administration's reaction to the event (ASP, Prefettura di Potenza, Gabinetto, I, 280, letter from the ministero to the prefetto, dated 17.1.1906). The prefect's inquiries broadened to encompass problems faced throughout Basilicata. On February 3 a circular was sent out which requested information from the municipalities. The circular (ibid, "Oggetto: condizioni di stabilità degli abitanti", dated 3.2.1906) was intended to uncover information on landslides, in order to prevent a recurrence of the events at Genzano. One hundred and twenty of the 125

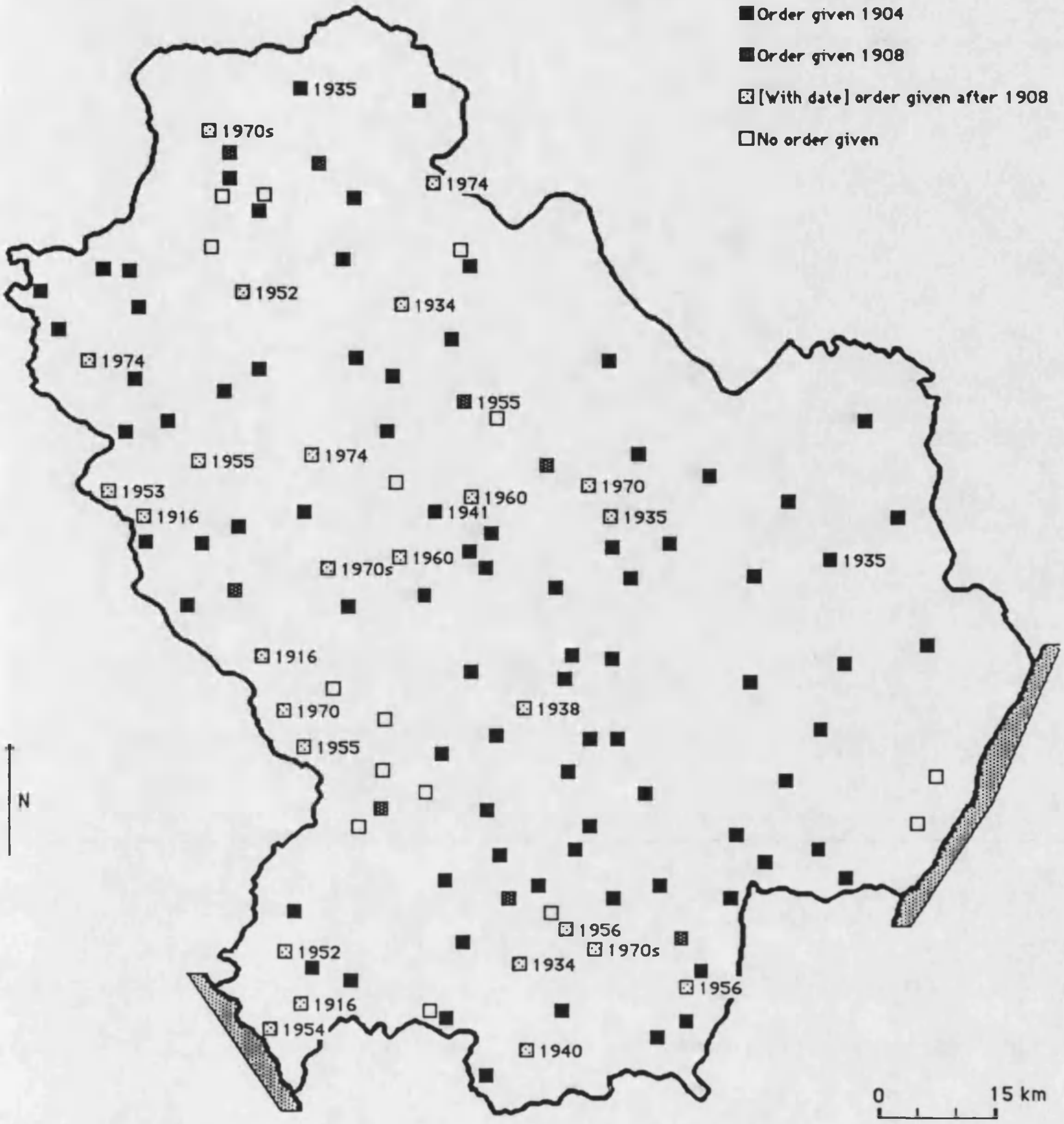

Figure 3.7 Basilicata: consolidation orders for urban centres (source: Regione Basilicata, 1987)

mayors in Basilicata reported on the urban landslides in their municipalities. The results were summarized (ibid, "Condizioni di stabilità degli abitati - (Circ. 3/2 n 169)") (figure 3.8).

A third source is the pattern shown by Almagià (1910). From his map of landslides it is possible to reconstruct the extent of landslides experienced by the town centres of 129 of today's 131 municipalities (there were 125 municipalities in Basilicata at the time, though four of the six towns which have subsequently become new municipalities were also shown). Almagià's data, the validity of which has already been discussed, was collected between 1904 and 1906. It shows that of the 129 towns fully 56 (that is 43%) were unaffected by landslides, 24 (19%) were "threatened" by landslides, and the remaining 49 (38%) had been "damaged" (figure 3.9).

A chi-square analysis of the regional landslide statistics (given in appendix B) shows that the number of urban landslides increased between the first decade of this century and 1986. The data on urban landslides from the first decade of the present century can be compared to that on urban landslides in 1986 (figure 3.10). Chi-square analysis shows there to be a very strong correlation between the data for 1906 and the data for 1910 - this corroboration implies that both measures give a reasonably accurate description of urban landslides at the time. The null hypothesis that there is no similarity between the two sets of data was rejected, with a probability of 0.0013. Chi-square analysis shows there to have been a mild correlation between the data for 1906/1910 and that for 1986. The null hypothesis that there is no similarity between the data for 1906 and 1986 was rejected, with a probability of 0.0296 and the null hypothesis that there is no similarity between the data for 1910 and 1986 was rejected, with a probability of 0.0396.

That 1906 and 1910 were very much more strongly correlated to each other than to 1986 implies a breakdown in the pattern of landslides which existed at the beginning of the present century. In addition, the contingency tables in appendix B show a number of cases where the reported level of landslides worsened between 1906/1910 and 1986:

• Of the 49 towns reported as not damaged by urban landslides in 1906: only 13 were reported as stable in 1986. Ten were reported as at risk from landslides, but 17 were reported as affected by small landslides, 8 were reported as affected by localized landslides, and 1 was reported as affected by widespread landslides (see table 3.4).

Figure 3.8 Basilicata: urban landslides in 1906
(source: ASP, Preff., Gab., I, 280)

Figure 3.9 Basilicata: urban landslides in 1910 (source: Almagià, 1910)

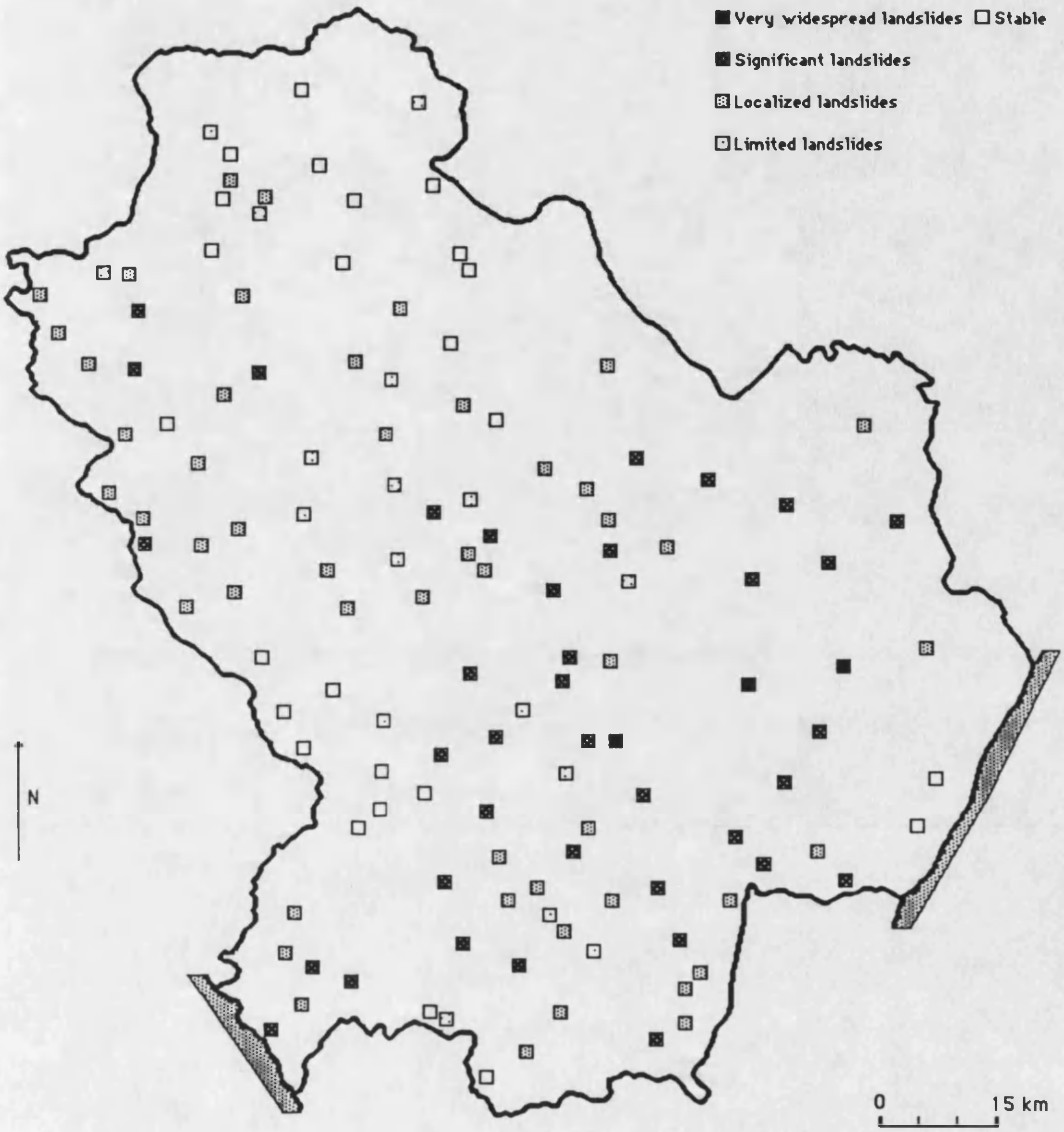

Figure 3.10 Basilicata: urban landslides in 1986 (source: Lazzari, 1986b)

Table 3.4: Basilicata: urban landslide data (sources: ASP, Prefettura di Potenza, Gabinetto, I, 280, "Oggetto: condizioni di stabilità degli abitanti", dated 3.2.1906; Almagià, 1910; Lazzari, 1986b)

Town	*1906*	*1910*	*affected 1977-87*	*1986*	*consolidation order/s*
Province of Matera:					
Accetura	2	2	2	4	1904
Aliano	2	3	2	5	1904
Bernalda	2	2	1	3	1904
Calciano	•	1	2	3	1970
Cirigliano	2	2	2	4	1904
Colobraro	1	1	2	4	1904
Craco	1	2	2	5	1904
Ferrandina	1	1	2	4	1904
Garaguso	1	1	2	3	1935
Gorgoglione	1	3	2	4	1904
Grassano	2	1	2	4	1904
Grottole	2	2	2	4	1904
Irsina	1	3	1	3	1904
Matera	1	1	1	3	1904
Miglionico	2	3	2	4	1904
Montalbano Jonico	2	3	2	4	1904
Montescaglioso	2	2	2	4	1904
Nova Siri	1	3	1	4	1904
Oliveto Lucano	2	3	2	4	1904
Pisticci	2	3	2	5	1904
Policoro	•	1	0	1	none
Pomarico	•	3	2	4	1904 and 1935
Rotondella	1	1	1	3	1904
Salandra	2	3	2	3	1904
San Giorgio Lucano	2	3	1	3	1904
San Mauro Forte	1	3	1	2	1904
Scanzano Jonico	•	1	0	1	none
Stigliano	2	3	2	3	1904
Tricarico	1	2	2	3	1908
Tursi	2	1	2	4	1904
Valsinni	2	1	1	4	1904
Province of Potenza					
Abriola	1	1	2	3	given, but no date
Accerenza	2	3	1	3	1934
Albano di Lucania	2	1	2	2	1960
Anzi	1	1	1	2	1960
Armento	2	3	2	4	1904
Atella	1	1	0	1	none
Avigliano	2	1	2	4	1904
Balvano	2	1	2	3	1904
Banzi	•	1	0	1	none
Baragiano	2	2	0	1	1904
Barile	•	3	1	3	1904
Bella	•	3	2	4	1904
Brienza	2	2	2	3	1904
Brindisi di Montagna	1	1	1	2	none

Calvello	1	3	2	3	1904
Calvera	2	3	2	3	1904
Campomaggiore	2	3	1	4	1904
Cancellara	1	3	1	2	1904
Carbone	2	2	1	3	1908
Castelgrande	2	1	1	3	1904
Castelluccio Inferiore	2	3	1	2	1904
Castelluccio Superiore	1	1	0	1	none
Castelmezzano	2	1	1	3	1904
Castelsaraceno	2	3	2	4	1904
Castronuovo di Sant'Andrea	2	3	2	4	1904
Cersosimo	1	3	1	3	1904
Chiaromonte	1	1	1	3	1904
Corleto Perticara	2	3	2	4	1904
Episcopia	•	2	2	4	1934
Fardella	1	1	1	3	1956
Filiano	•	1	1	3	1952
Forenza	1	3	0	1	1904
Francavilla	2	1	1	2	given, but no date
Gallicchio	2	3	1	4	1904
Genzano di Lucania	2	3	0	1	1904
Ginestra	•	•	1	2	none
Grumento Nova	1	•	0	1	none
Guardia Perticara	1	1	1	2	1938
Lagonegro	2	1	2	3	1904
Latronico	1	1	2	4	1904
Laurenzana	2	3	2	3	1904
Lauria	2	3	2	4	1904
Lavello	2	1	2	1	1904 and 1935
Maratea	1	1	2	4	1954
Marsico Nuovo	1	1	0	1	1916
Marsicovetere	1	1	0	1	none
Maschito	2	2	0	1	1904
Melfi	1	1	1	2	given, but no date
Missanello	1	3	2	2	1904
Moliterno	1	2	0	1	none
Montemilone	2	3	1	2	1904
Montemurro	2	3	2	4	1904
Muro Lucano	1	1	1	3	1974
Nemoli	2	3	2	4	1904
Noepoli	1	1	2	4	1908
Oppido Lucano	2	3	0	1	1904
Palazzo San Gervasio	2	1	0	1	1974
Paterno	•	1	0	1	1970
Pescopagano	2	1	1	3	1904
Picerno	2	1	1	3	1955
Pietragalla	•	3	1	3	1904
Pietrapertosa	2	3	1	3	1904
Pignola	2	3	1	2	1904
Potenza	1	1	1	2	1974
Rapolla	2	1	0	1	1908
Rapone	1	1	1	2	1904
Rionero in Vulture	1	1	0	1	none
Ripacandida	2	2	1	2	1904
Rivello	1	1	1	3	1952
Roccanova	2	2	2	3	1904
Rotonda	1	2	0	1	1904
Ruoti	1	3	2	3	1904

Ruovo del Monte	1	3	1	3	1904
San Chirico Nuovo	•	1	0	1	none
San Chirico Raparo	1	2	1	3	1904
San Constantino Albanese	2	3	1	3	1904
San Fele	•	3	2	4	1904
San Martino d'Agri	2	3	2	4	1904
San Paulo Albanese	2	1	2	3	1956
San Severino Lucano	1	3	1	3	1904
Sant'Angelo le Fratte	1	2	2	4	1904
Sant'Arcangelo	2	2	2	4	1904
Sarconi	1	2	0	1	1908
Sasso di Castalda	2	2	1	3	1908
Satriano di Lucania	2	3	2	3	1904
Savoia di Lucania	•	2	1	3	1916
Senise	2	1	2	4	1904
Spinoso	1	1	0	1	none
Teana	1	1	1	2	none
Terranova di Pollino	2	3	2	4	1904
Tito	2	3	2	3	1904
Tolve	2	2	1	3	1908 and 1955
Tramutola	1	1	0	1	1955
Trecchina	1	1	1	3	1916
Trivigno	•	3	1	4	1904 and 1941
Vaglio Basilicata	•	1	1	3	1904
Venosa	1	2	0	1	1908
Vietri di Potenza	1	1	2	3	1953
Viggianello	•	1	1	3	1940
Viggiano	•	1	1	2	none

Codes:

For 1906: 1 = not damaged by urban landslides, 2 = damaged by urban landslides, • = missing or ambiguous data (source: ASP, Prefettura di Potenza, Gabinetto, I, 280, "Oggetto: condizioni di stabilità degli abitanti", dated 3.2.1906).

For 1910: 1 = not damaged by urban landslides, 2 = threatened by urban landslides, 3 = damaged by urban landslides, • = missing or ambiguous data (source: Almagià, 1910).

For affected 1977-87: 0 = never affected, 1 = not affected 1977-1987, 2 = affected 1977-1987 (source: Regione Basilicata, 1987, Lazzari 1986b)

For 1986: 1 = sufficiently stable, 2 = at risk from landslides, 3 = affected by small landslides, 4 = affected by localized landslides, 5 = affected by widespread landslides (source: Lazzari, 1986b).

For the date of consolidation orders: 1904 [etc] = date consolidation order made (source: Regione Basilicata, 1987).

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• Of the 56 towns reported as not damaged by urban landslides in 1910: only 15 were reported as stable in 1986. Ten were reported as at risk from landslides, but 21 were reported as affected by small landslides, 10 (including Grassano) were reported as affected by localized landslides, and none was reported as affected by widespread landslides (see table 3.4).

• Of the 24 towns reported as threatened by urban landslides in 1910: only 6 were reported as stable in 1986. One was reported as at risk from landslides, but 9 were reported as affected by small landslides, 7 were reported as affected by localized landslides, and 1 was reported as affected by widespread landslides (see table 3.4).

Corroboration of the pattern of worsening urban landslides is given by the government's scheduling of towns for consolidation against landslides (table 3.4, figure 3.7). Rescheduling indicates the recurrence of problems, but the growth in consolidation orders shown in table 3.5 seems to represent an administrative recognition of a worsening position, rather than the acceptance of an existing one. It is not correlated with the growth in spending which only took place from the 1970s.

Table 3.5: Basilicata: consolidation orders (source: Regione Basilicata, 1987)

Year	*Towns*	*Hamlets*
1904	82	-
1908	9	-
1910s	3	1
1920s	0	2
1930s	4 (and 2 rescheduled)	1
1940s	1 (and 1 rescheduled)	1
1950s	8 (and 1 rescheduled)	1
1960s	2	1
1970s	8	0

3.3 Conclusions

This chapter has examined the wide variety of information on landslides in Basilicata, and showed instability to be both severe and widespread. It then examined the hypothesis that landslides have increased in recent centuries, according to the information reported on urban landslides, and at many towns such as Grassano the landslide hazard has increased significantly. There are, however, difficulties in assessing historical rates of landslides, because of a lack of evidence. Research on the dating of individual landslides is limited: though the evidence from process studies reported in chapter four implies that, as a result of recent environmental change, the number of landslides will have increased. Although this chapter has shown that the number of recorded landslides has increased, that could be the result either of more assiduous reporting or a real increase in landslides.

The pattern of increased reported landslides demands an explanation: a number of factors which may have accounted for it are outlined in the next chapter, and they imply that the reported increase was in part a real increase. Chapter five examines the reasons that account for the documented increase at Grassano. Chapter six shows that there has been a real increase in landslides. Chapter seven takes up the issue raised here - whether and why there has been an increase in the sensitivity to landslides which may account for some of the reported increase in landslides.

Chapter 4: The reasons for landslides in Basilicata

This chapter examines the factors involved in the apparent increase in landslides reported in chapter three. It assesses first the importance of the physical factors and then the importance of the social factors that have accounted for this change.

4.1 Introduction

As chapter two showed, landslides are environmental hazards that have highly complex causes which can be traced to both physical factors and social factors. This chapter considers the regional structuration factors which influence landslides throughout Basilicata - but are modified by contingent local factors.

Basilicata is a predominantly mountainous region at the southern end of the Apennine mountains, and there is a variety of physical factors that predisposes the region to a high "normal" level of landsliding. The mechanical instability characteristic of slopes is accentuated by climatic extremes of heat and cold, of summer drought and heavy autumn/winter rain; much of the vegetation is sparse and heavily degraded; a large proportion of the region is composed of fragile geological formations, and the mainly mountainous terrain produced by intense tectonism is heavily denuded and steeply sloping; in addition much of the region is subject to high-magnitude earthquakes.

The impact of these physical problems is made more intense by the longstanding economic poverty of Southern Italy, the "Mezzogiorno", which Basilicata shares. Since medieval times Southern Italy has remained detached from the relative dynamism of Northern European culture: by the nineteenth century it was already relatively poor, and this poverty was accentuated when the North industrialized (King, 1987). Economic poverty has brought with it an environmental poverty, because much of the region's land has been overexploited. The results of degradation, such as landslides, are widespread.

4.2 The physical factors

4.2.1 Introduction

According to Ranieri (1972, 43-44, translated) the main physical factors which control the nature of slopes and the forces which act on them at the regional scale in Basilicata are: relief, geology, climate, vegetation, and tectonism and seismicity.

> The prevalence of Tertiary deposits - flysch, silty clays, silty sandstones, and particularly clays - which show little coherence and are easily eroded by running water, and the very high levels of precipitation, make Basilicata the most landslide-prone part of the Apennines and of Italy...
>
> It is easy to see how this tragic misfortune, which is without doubt mainly the result of the region's geology, has been made worse by the widespread deforestation which occurred without hindrance between 1808 and 1880... The deforestation of the woodlands, which had acted as the major natural protection against rainfall, set in motion an intense period of soil erosion, which led to landslides and a number of other unfortunate consequences.
>
> It should also be remembered that, in Basilicata, landslides and slope instability in general is also significantly increased by a high level of seismicity...

The physical factors are important in predisposing Basilicata to a high level of landslides - but they are not be the only triggering factors. The importance of other factors in explaining slope instability was commented on by Puglisi (1977, 92, translated): "Although the key to understanding the obscure causes of the slope instability is found in the rock lithology and in tectonic changes, other factors - climate and human action - also have a role in causing it." The situation in much of Basilicata is similar to that in the neighbouring region of Calabria where human action has had a significant impact on what was already a very fragile environment, as was noted by Brunsden, Kirkby, and Kirkby (1973, 361): "Geological youth and mobility, the delicate vegetation and erodible lithologies combine with the extremes of mediterranean and mountain climates to produce circumstances which are favourable to high rates of erosion, rapid development of flood water and intensive landsliding." These factors will be dealt with in the remainder of section 4.2.

4.2.2 Relief

Basilicata's relief is dominated by the Apennines, which the region straddles. From the Tyrrhenian coast in the west, the land rises rapidly to over 1,000 m above sealevel. A number of the Apennine peaks such as Monte Vulturino, Monte Alpi, and Monte Sirino approach or even exceed 2,000 m in altitude. From the Apennine highlands, the land descends towards the wide coastal plains of Metaponto and the Ionian Sea (figure 4.1), dissected by the main rivers Bradano, Basento, Cavone, Agri, and Sinni (figure 4.2). Mountain building, local tectonic instability, and active erosion processes working together have produced a steeply sloping relief: there are very few gentle slopes, and 70% of the land is classified as mountainous, 22% as hilly, and 8% as flat (Ranieri, 1972). Mean rates of erosion are very high: erosion for the Bradano basin averaged 1,159 tonnes per km^2 per year before the construction of the San Giuliano dam, for the Crati basin it was 1,003 tonnes per km^2 per year, and 2,451 tonnes per km^2 for the Sinni basin (Regione Basilicata, 1987).

High rates of erosion encourage slope instability by the removal of lateral or underlying support (Beaty, 1959), and localized surcharging and lateral pressure (see Regione Basilicata, 1987). Carrara and others (1978) found a Kendall correlation coefficient of 0.45 (significant at over 99%) between the intensity of erosion and slope instability in the Ferro basin on the boundary between Basilicata and Calabria. Gulleying is a very widespread phenomenon - as Rossi-Doria (1963, 42, translated) commented: "All the watercourses which cross the region... have a torrent-like character and more-or-less pronounced gulley features on their banks." Erosion can reach very high levels on some geological deposits in the region. According to Brückner (1982, and 1990) rates of erosion, greatly accelerated by human occupation, have averaged 0.58 mm per year in the Basento valley near Ferrandina, and 0.61 mm per year in the Cavone valley since 636,000 BP. Locally, figures can be even higher. Working in Tricarico, Rendell (1982) found inter-rill erosion rates on clay varying between 5.3 mm a year and 36.4 mm a year (though these figures were later disputed: Yaalon, 1983; Rendell, 1983). Alexander (1982b) found rates as high as 20 to 30 mm per year on some clays.

As table 4.1 shows, all but one of the mass movement types identified in *Il dissesto idrogeologico della Basilicata* (1984, 52-53) had its modal distribution in the slope

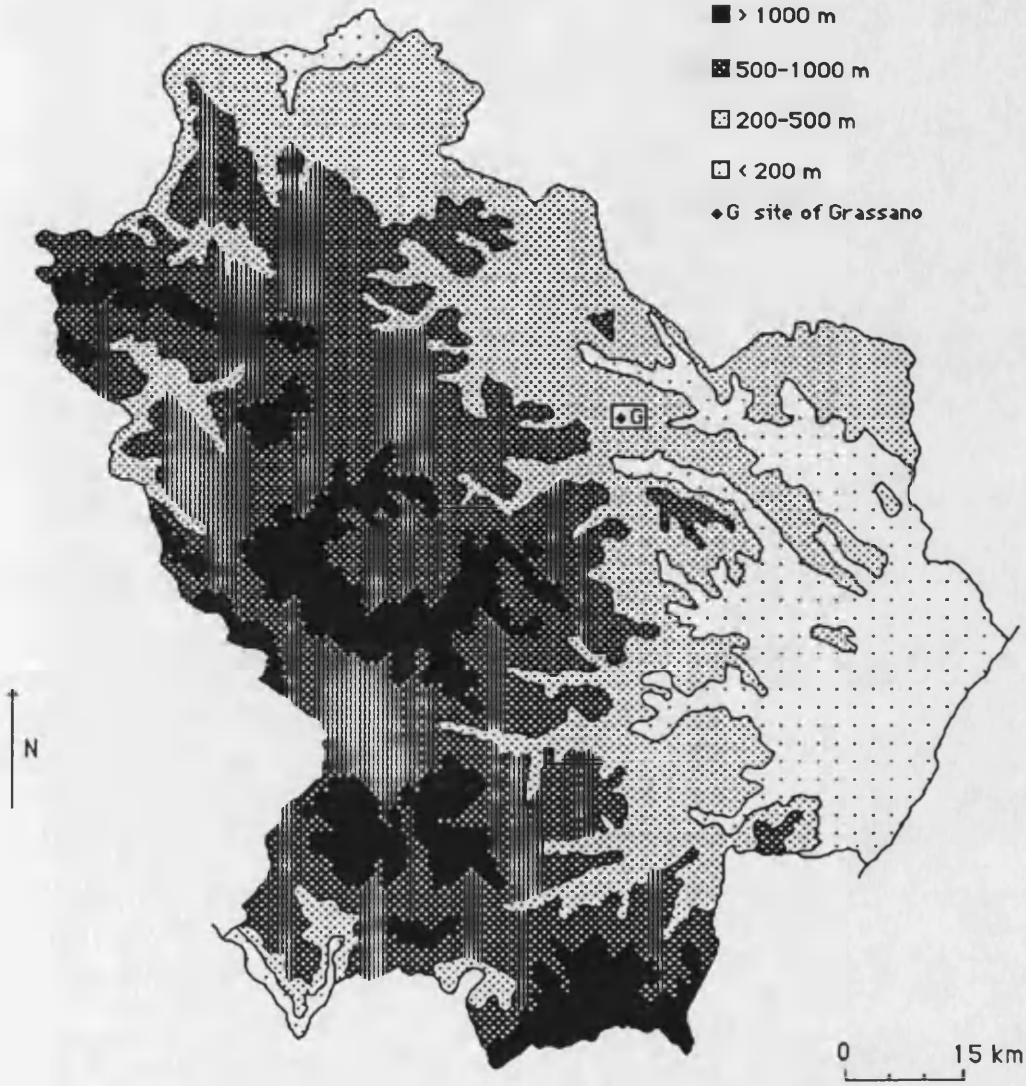


Figure 4.1 Basilicata: relief (source: Ranieri, 1972)

Figure 4.2 Basilicata: major rivers (source: Ranieri, 1972)

class category 18-30° (the exception being rockfalls, much less dependent than other forms of mass movement on the thickness of regolith). Similarly Calcagnile, Palmentola, and Pennetta (1982) found close correlations between slope inclination and instability which are probably applicable for the rest of the region: slopes of up to 10° were almost always stable, slopes of 10° to 20° produced some instability in clay lithologies, slopes of 20° to 40° were unstable for all lithologies, and slopes of over 40° were very unstable.

Table 4.1: Basilicata: the relationship between slope steepness and type of slope instability (source: *Il dissesto idrogeologico della Basilicata*, 1984)

Slope steepness (degrees)	*0-5*	*5-10*	*10-18*	*18-30*	*30-45*	*>45*
Instability type						
Sheet erosion	0	6	9	31	29	25
Rill erosion	0	7	7	37	22	27
Calanchi erosion	0	0	3	49	24	24
Superficial slips/ solifluction	0	8	10	55	18	10
Lateral spreads	0	3	2	66	16	14
Rotational slides	0	4	4	72	11	10
Translational slides	0	3	5	42	14	36
Rockfalls	0	0	2	22	20	56
Complex landslides	0	0	2	76	12	10

4.2.3 Geology

Ranieri (1972) placed geology as of major significance, after relief, in the factors he listed as of importance in causing landslides in Basilicata - and the pattern of landslides in the region is substantially controlled by it. Located at the southern end of the Apennines, subject to intense and continuing orogeny, Basilicata has a complex geological structure (Pieri, 1975; Mudge, unpublished, 1991). This structure resulted from the formation of the Apennines which began in the Upper Miocene, during the subsidence of the Tyrrhenian post-orogenic basin. It came as a result of the movement of the Apennine thrust belt which is either an extension of the African plate (Channel, D'Argenio, and Howarth, 1979) or a separate microplate (Lort, 1971).

The evolution of Basilicata's geology is discussed in Mudge (unpublished, 1991). The main uplands of the Apennines are formed of calcareous dolomites and a mixture of arenaceous schists and clays. To the east are the more chaotic deposits of Pliocene sandy clays ("flysch"). Through the central zone of the region are areas of volcanic rocks, sandstones and sandy schists, and sandy conglomerates. Alluvium covers the valleys of the major rivers flowing towards the Ionian coast, and the coastal area is covered in marine deposits (figure 4.3).

Many of the region's geological formations, particularly silts and clays, are vulnerable to erosion. These vulnerable formations cover most of Basilicata - Alexander (1982a) showed that at least 54% of Basilicata is underlain by fine-grained cohesive sediments, and 19% of the region consists of overconsolidated Plio-Pleistocene marine silt clays which are prone to erosion once the overburden has been removed. Of the thirty-five lithological complexes identified by *Il dissesto idrogeologico della Basilicata*, three had over 50% of their area affected by shallow mass-wasting processes and six had over 5% of the surface area covered by deep landslides.

More specifically, 81% of the area of heterogeneous chaotic clays were affected by landslides: they outcrop over 0.8% of the region; the complex is mainly composed of silicide varicoloured clays with a medium to high plasticity, strength, and compressibility. Permeability is very low: and as a consequence, instability, gulleying, and undercutting cause landsliding in many areas. Forty-seven percent of calcareous silty sandstones are affected by landslides, characterized by calcareous and sandy components, which outcrop over 0.6% of the region. Fifty-nine percent of paleolandslide deposits are affected by contemporary landslides: they outcrop over 2.6% of the region and are composed of a wide variety of rock types with a large range of characteristics.

Deep landslides affect 42% of paleoslide deposits - far more than the next-highest figure of 7.6% of calcareous silts (which outcrop over 2.9% of the region); 7.0% of heterogeneous clays (which outcrop over 3.1% of the region); 5.9% of conglomerates (which outcrop over 0.6% of the region); 5.4% of chaotic heterogeneous clays (which outcrop over 4.6% of the region); and 5.3% of sandy silts (which outcrop over 1.1% of the region).

The control of lithology on landslides has been confirmed in a number of specific case studies. For example, Carrara and others (1978) found a Kendall correlation

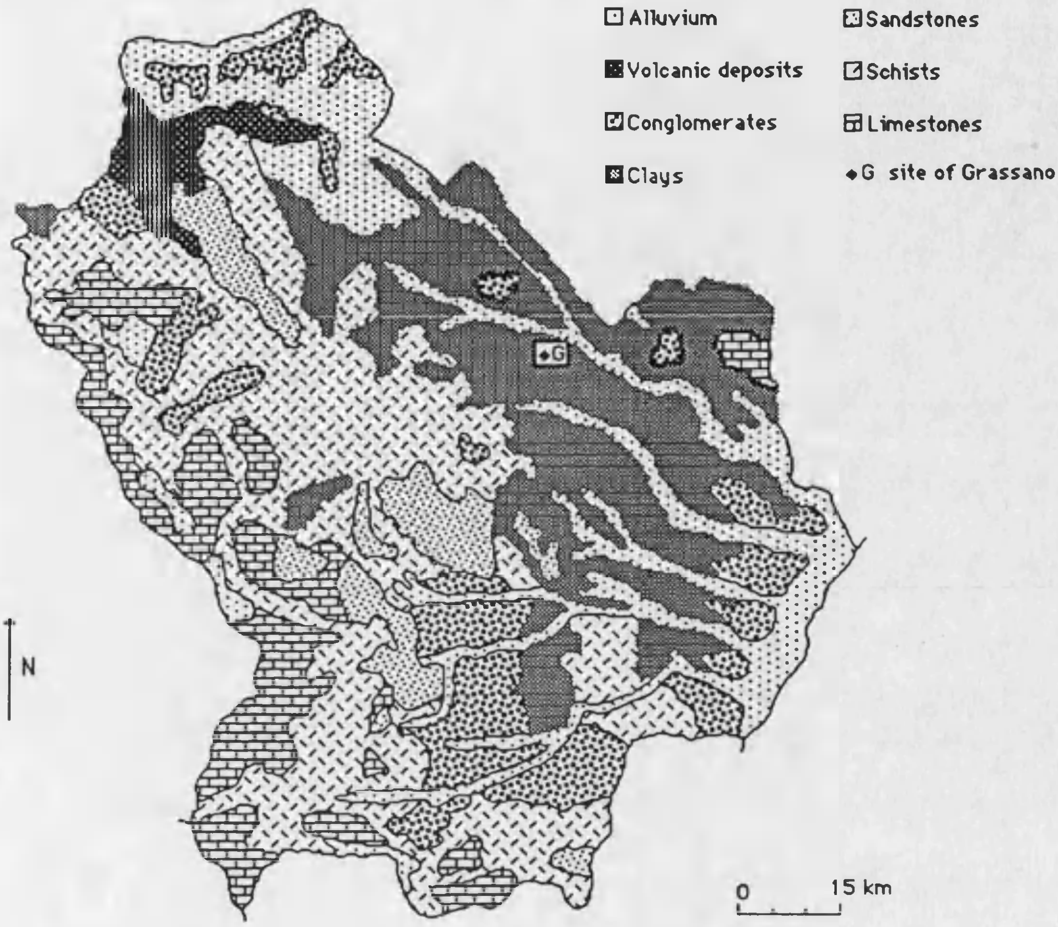


Figure 4.3 Basilicata: geology (source: Ranieri, 1972)

coefficient of 0.38 (significant at over 99%) between rock type and slope instability in the Ferro basin. Contingency-table analysis showed a Kendall correlation coefficient of 0.09 between the two - significant at over 99%. They found the modal class of landslides for Albidonian flysch was slide/flow, for varicoloured clays it was slide/flow, for Miocene deposits it was slide, for Plio-quaternary deposits it was slide/flow, and for alluvium it was flow (table 4.2).

Table 4.2: Ferro Basin: the relationship between lithology and the type of landslide (source: Carrara and others, 1978)

Lithological type	*Percentage affected by each type of instability*			
	slide	fall	flow	slide/flow
Albidonian flysch	33.8	0.6	16.3	49.3
varicoloured clays	31.5	0.3	17.4	50.8
Miocene	60.2	6.0	7.2	26.5
Plio-quaternary	33.3	6.7	13.3	46.7
alluvium	23.1	1.0	38.5	37.5
mean	33.7	0.8	17.2	48.4

Similarly, Van Asch (1980), working in northern Calabria, found a number of significant correlations between the distribution of landslides and the four main lithologies: metamorphic, silt-claystones, sandstone, and granite. Most resistant to landslides were metamorphic rocks, outcropping over 53% of the studied area and accounting for 28% of the area of landslides. By contrast, silt-claystones outcropped over 28% of the studied area but accounted for 42% of the area of landslides. Sandstones and granite tended to produce the most superficial landslides, silt-claystones the deepest (table 4.3).

Table 4.3: North Calabria: the relationship between lithology and the size of landslides (source: Van Asch, 1980)

Lithology of landslides	*% of area of landslides*	*% number of landslides*	*% area*	*% volume*
Metamorphic	53	29	28	23
Silt-claystone	20	36	42	58
Sandstone	27	32	28	19
Granite	0.7	3	1	0.3

Kayser (1963) noted the importance of soil structure as a factor determining landslides in Basilicata. Soils based on more coherent bedrocks tend to be less affected by soil erosion - and consequently by gulleys and landslides. He found that landslides most frequently affect areas of sandy soils - especially those that have lost their topsoil and are desiccated - and areas of plastic clay soils. He classified almost 40% of soils he tested throughout Basilicata as clay soils, and over 30% of the remainder had high sand contents.

Alexander (personal communication) has suggested that the neotectonic instability of Basilicata makes discontinuities very important as a preparatory factor for landslides - though an underrated one. Some direct links have been found between structure and landslides in Basilicata. In the case of the Orco-Sativo river basin, in the municipality of Vaglio Basilicata, Alexander (1990) found that intense fracturing was highly significant in the creation of unstable land. Similarly, Guericchio and Melidoro (1979) found that neotectonic movements have often acted as preparatory factors in landslides, and have been one of the causes of the widespread calanchi erosion in the municipality of Pisticci. Throughout Basilicata numerous paleoslides have been reactivated (Regione Basilicata, 1987) - probably including the paleoslide at Grassano which is discussed later in this dissertation.

4.2.4 Tectonism and seismicity

Basilicata is subject to significant neotectonic activity. Ghisetti (1981) quoted data for the neighbouring region of Calabria which demonstrated significant uplift rates - past and present: on deposits laid down by 1.4 million years BP he found uplift rates of 0.06 to 0.63 mm a year, 0.03 to 0.08 mm a year since 700,000 BP, 0.1 to 0.8 mm a year since 200,000 BP, and 0.93 to 1.5 mm a year since 80,000 BP. Rates of uplift were probably similar in Basilicata (Cotecchia and Magri, 1967; Neboit, 1981-1982), though Valentini (1979) reported that the uplift had apparently been more intense towards the south of Basilicata along the boundary with Calabria. The effects of tectonic activity, compounded by isostatic changes of 100 m since 13000 BP (Ghisetti, 1981), have produced a highly active rejuvenation associated with intensified gulleying and landslides.

As a result of its location astride the tectonically-active Apennines, Basilicata is chronically unstable in seismic terms and has been affected by numerous earthquakes. Calcagnile and others (1977) identified no fewer than 119 recorded earthquakes which have affected the region with intensities of VI or above on the Mercali scale. Of these, 70% have been in the last 170 years (an indication of improved documentation, they suggested). Seismicity is concentrated in the west and northwest of the region (Regione Basilicata, 1987) (figure 4.4).

The intense tectonic activity which affects Basilicata "actively determines and predisposes numerous and at times impressive mass movements" (Cotecchia and Melidoro, 1974, 23). Calcagnile and others (1977) found that earthquakes with an intensity of MSK VII (capable of causing rock slumps - according to Keefer, 1984) have a current return period in Southern Italy of eight years (with a confidence limit ranging between six and ten years). Earthquakes with an intensity of MSK X have a return of 58 years (with a confidence limit ranging between 27 and 122 years).

Many large landslides have occurred in Basilicata after earthquakes. Landslides after the earthquake of 17 and 18 December 1857 killed probably 500 at Montemurro when gulley slopes slumped after the seismic shock (Regione Basilicata, 1987) - though Almagià (1910) gave the number of deaths as 5,000. No other earthquake has produced an equivalent disaster: but many have had a considerable effect on Basilicata's geomorphology. The shocks associated with the 23 November 1980 earthquake produced mass movements, local uplift, small surface cracks, fractures in rocks, and surface movements of faults (Lippmann, 1984). At the epicentre of the earthquake in Campania (MM IX, or X), there were major landslides - especially where structural features like faults and old landslides could be re-activated.

4.2.5 Climate

The current climate of Basilicata is highly conducive to the development of landslides. It is characteristic of the "warm temperate" zone which includes the Mediterranean area, typified by alternating drought and wetness (promoting landslides and torrential streams) and a relatively thinner A-soil horizon than more temperate areas (which leads to lower storage of precipitation and more flashy hydrological regimes, and a quicker and more frequent inundation of the subsoil - Tricart and Cailleux, 1972).

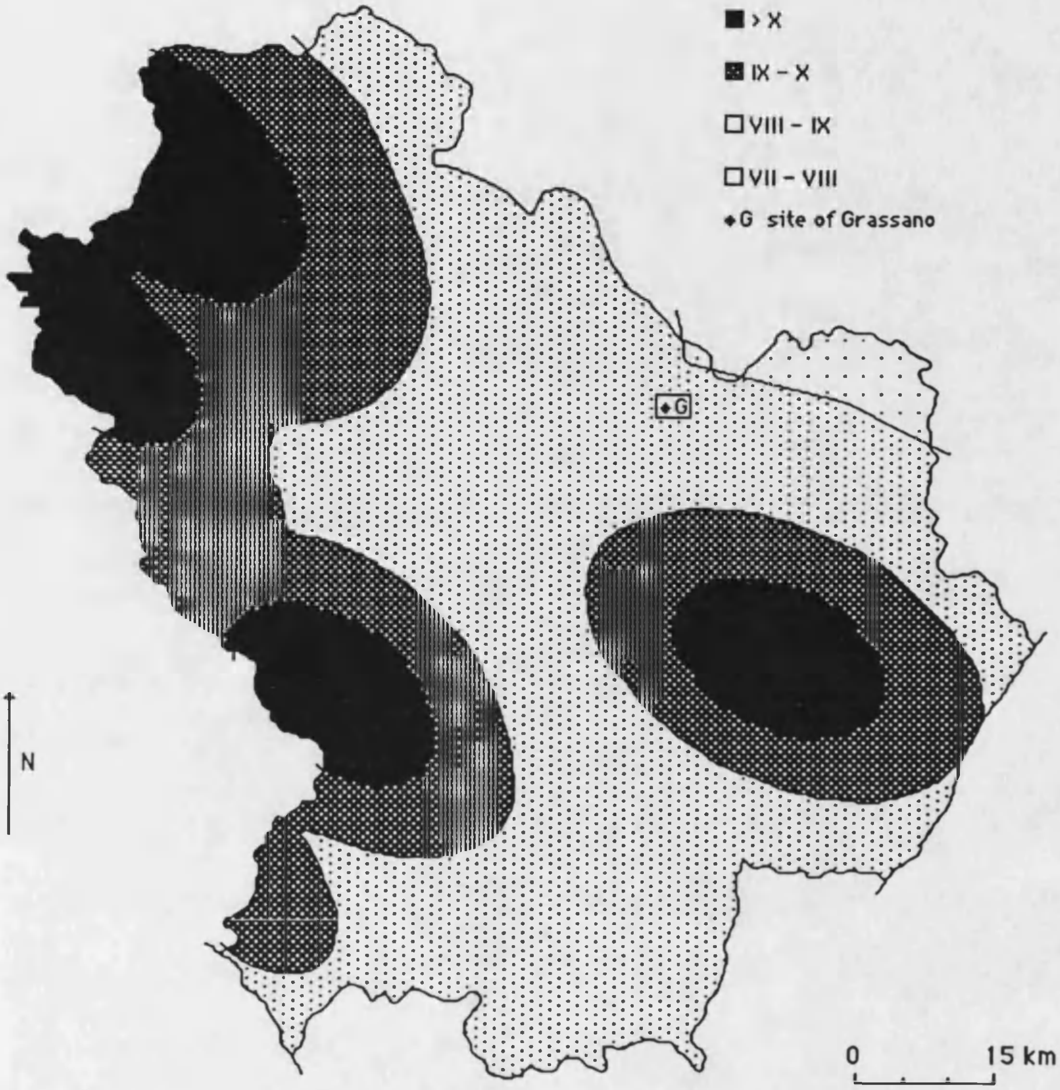


Figure 4.4 Basilicata: seismicity (composite isoseismals in MS units for 1534 to 1973 - Regione Basilicata, 1987)

The climate varies mainly by altitude and distance from the (western) Tyrrhenian coast. The east of the region is warmer in summer and drier (an effect accentuated by the rainshaddow from the Apennines). Higher altitudes are cooler and wetter, but all parts of the region have what can broadly be described a mediterranean climate. Ranieri (1972) divided the climate of Basilicata into three sub-types on the basis of longitude, relief, and altitude. They were: the Apennine (for example Potenza, altitude 826 m); the Eastern Hills (for example Tricarico, altitude 698 m); and the Ionian Coast (for example Metaponto, municipality of Bernalda, altitude 3 m) (table 4.4).

Table 4.4: Basilicata: selected climatic data for 1926 to 1955 (source: Ranieri, 1972)

Station	*Mean temperature: in ^{o}*		*Mean precipitation: in mm*		
	January	*July*	*January*	*July*	*per year*
Potenza	3.5	21.9	100	25	763
Tricarico	4.2	23.2	71	25	647
Metaponto	8.0	26.0	72	15	551

Precipitation is highest in the Apennines, rising to over 2,000 mm a year around Lagonegro (figure 4.5). It falls to under 600 mm a year between Venosa and the Ionian coast, with less than 500 mm a year near Metaponto. The southwest and, particularly, the southeast of the region experience the most intense precipitation: in the period 1921 to 1970, for example, almost all of Basilicata had experienced a maximum precipitation of over 100 mm in a given twenty-four-hour period - with the area around Pisticci having one event over 300 mm (Regione Basilicata, 1987).

Kayser (1963) described precipitation as the major triggering factor for landslides in Basilicata. Many significant landslides have been recorded after heavy rain, particularly notable recent examples being the landslide at Ferrandina in 1959, and the storm in November 1976 which caused landslides at Giarossa, Grassano, and Pisticci (Regione Basilicata, 1987). Some of the damage produced by landslides after the earthquake of 23 November 1980 can be put down to the heavy rain which fell on several days after the shock (Alexander, 1983).

Summer drought (especially pronounced towards the Ionian Coast) can lead to desiccation and cracking in the soil combined with a die-back in plant cover. It is most

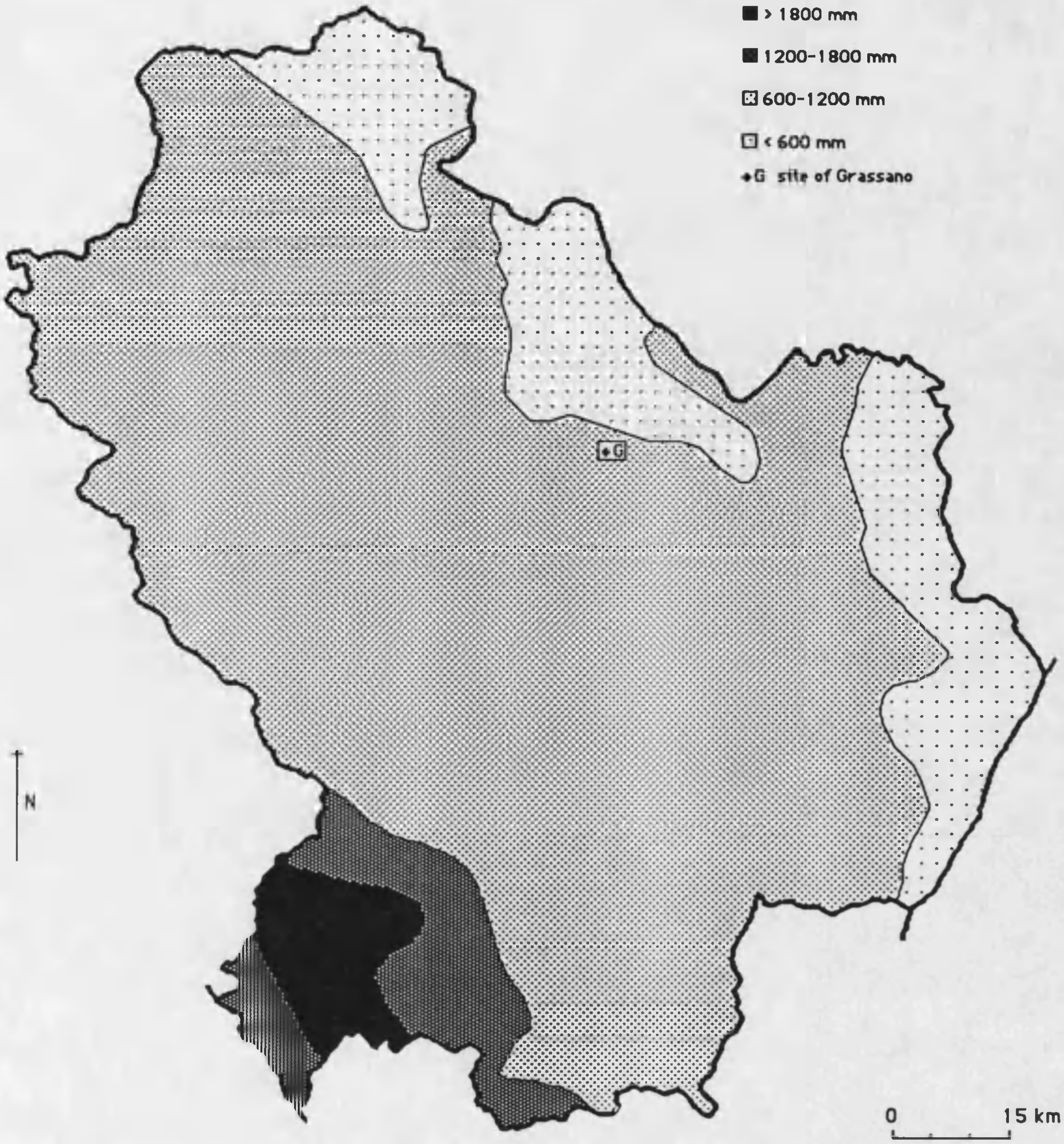


Figure 4.5 Basilicata: precipitation (source: Ranieri, 1972)

pronounced in the centre and north of the region. North of Lavello, and between Montalbano Jonico and Pietrapertosa, the mean absolute drought in August exceeds twenty-five days (Regione Basilicata, 1987). After the end of the summer drought the intense precipitation of the autumn (particularly in the Apennines), combined with a crop and vegetation cover reduced by desiccation, actively promotes erosion and landslides (Kirkby, 1980).

Most significantly for the development of landslides the climate is now drier than during the sixteenth or nineteenth centuries (D'Arrigio, 1951; Vita-Finzi, 1969): yet as chapter three shows, reported landslides are increasing. This indicates that although climate is of fundamental importance in determining exogenic regimes, it is not a major controlling factor in the reported increase in landslides since the nineteenth century. The changes that have occurred in Basilicata can as a consequence only be understood in the context of the human modification of the region's vulnerable environment.

4.2.6 Vegetation

The natural vegetation of Basilicata is characteristic of the Mediterranean and can be divided into three principal zones according to Ranieri (1972). Between sealevel and 500 m is the the Mediterraneo (lowland) zone composed of macchia, moorland, and meadow species. Between 500 m and 1,800 m is the Piano Montano (upland) zone composed of woodland, meadows, and alpine species with dwarf oak forest. And above 1,800 m is the the Piano Alpino (alpine) zone composed of alpine species. However, the area occupied by the natural vegetation is very limited in Basilicata (figure 4.6). According to Istituto Centrale della Statistica (1985a and b) 85.8% of the land in Basilicata is used for cultivation, although agriculture is largely confined to below 1,000 m altitude (Ranieri, 1972). Some woodland remains, mainly in the uplands and covers 19.9% of the whole region (Istituto Centrale della Statistica, 1985a and b) - or 22.4% according to *Il dissesto idrogeologico della Basilicata* (1984). The figures given in *Il dissesto idrogeologico della Basilicata* for the use of the land are given in table 4.5.

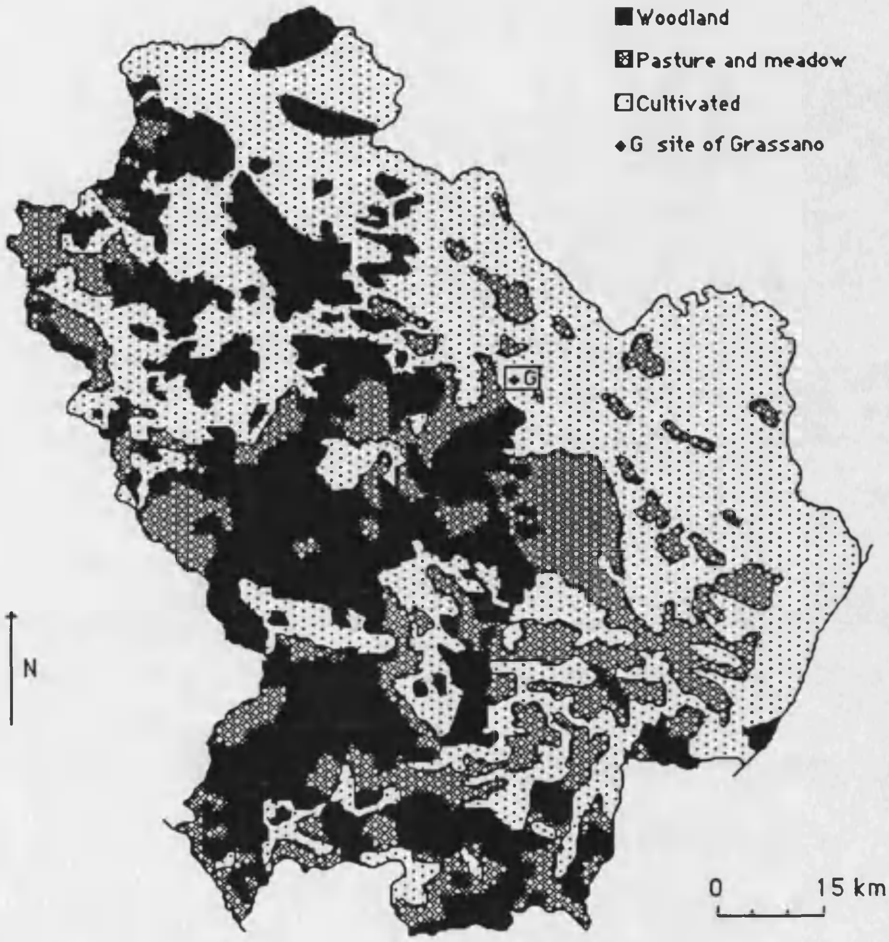


Figure 4.6 Basilicata: landuse (source: Catadella, 1990)

Table 4.5: Basilicata: landuse (source: *Il dissesto idrogeologico della Basilicata*, 1984)

Landuse	*area (ha)*	*coverage of region (%)*
Grain	586,227	58.6
Pasture and uncultivated	121,732	12.2
Woodland (high quality)	158,869	15.9
Woodland (low quality)	65,295	6.5
Reforestation/consolidation	40,900	4.1
Other	26,969	2.7
Total	999,200	100

Accelerated erosion caused by deforestation is very widespread (Kayser, 1961). Given the vulnerability of the region's ecosystems this is unsurprising. Basso and Linsalata (1983) detailed the result of experiments carried out on plots near Guardia Perticara between July 1973 and June 1976. The mean yield of soil sediment dry matter varied significantly: meadow gave 0.915 tonnes per ha per year with cross-slope ploughing; but under the same conditions grain gave 4.480 tonnes per ha per year.

The significant differences which various types of land uses have on landslides can be gauged from the data on the percentage of land-use types affected by mass movement phenomena given in table 4.6. Meadowland and uncultivated land is more vulnerable to all processes than either woodland or cropland. Although woodland is more vulnerable to shallow landslides than cropland (this is probably a spurious correlation - woodland tends to be at higher altitudes than cropland) it is less vulnerable to deep processes.

Table 4.6: Basilicata: landuse and landslides (source: *Il dissesto idrogeologico della Basilicata*, 1984)

SHALLOW MOVEMENTS

Landuse	sheet erosion	rill erosion	calanchi erosion	superficial slips/ solifluction	(total)
Woodland	4.2	6.2	0.8	4.2	15.4
Cropland	2.5	4.0	0.4	8.4	15.9
Meadow/ uncultivated	9.4	14.8	8.1	16.6	49.9

DEEP MOVEMENTS

	lateral spreads	rotational slides	translational slides	rockfalls	complex landslides	(total)
Woodland	0.7	0.1	0.03	0.2	0.4	1.5
Cropland	0.8	0.8	0.04	0.1	0.6	2.3
Meadow/ uncultivated	2.8	1.1	0.1	0.4	2.9	7.4

A similar influence of vegetation on slope instability was discovered by Carrara and others (1978) (table 4.7). They produced a contingency table showing the correlation between five degrees of slope instability and seven landuse types. Although the relationship between slope instability and vegetation was not significant at 99% there were some interesting correlations evident, which indicated that land clearance has increased slope instability: for example, while active slope instability affected 8.6% of "bush" observations, it affected 34.6% of ploughed observations.

Table 4.7: Ferro Basin: landuse and landslides (source: Carrara and others, 1978)

Instability	*Landuse*						
	Bush	*degraded bush*	*olive grove*	*ploughed and trees*	*ploughed*	*abandoned*	*barren*
None	24.3	6.0	2.7	2.4	27.0	12.2	25.3
Stable	58.2	6.5	0.0	1.3	19.4	9.9	4.7
Dormant	15.6	14.0	1.0	3.1	35.2	22.0	9.1
Active/dormant	7.6	9.2	1.8	3.9	34.9	36.1	6.6
Active	8.6	9.1	2.5	4.5	34.6	34.2	6.6
Mean	16.2	9.1	1.8	3.3	32.2	26.7	10.8

Vegetation is an important factor in determining the level of landslides, but in an environment such as Basilicata's the vegetation that exists is largely dependent on the social needs which determine landuse.

4.2.7 Conclusions

This section has described the influence of physical factors on landslides in Basilicata. It has shown that Basilicata is a region vulnerable to landslides because of a combination of relief, geology, climate, and vegetation. However, it is clear that the environment of the region cannot be discussed in isolation from the work of humankind. The remainder of this chapter goes on to discuss the ways in which humankind has altered the environment of Basilicata, and has begun to humanize it. With this humanization, environmental hazards such as landslides have been changed significantly.

4.3 The social factors

4.3.1 Indirect impacts on the land

4.3.1.1 Introduction

The evidence already presented in chapter three suggests that in the case of Basilicata, humankind has greatly increased the number of urban landslides during the twentieth century. This does not mean that all landslides are influenced by humankind, but in a large proportion of them, human influence seems probable.

In Basilicata the most important element in the humanization of the land has been the acceleration of land degradation - the chronology of which is reasonably well known, particularly as the result of work in the region by Brückner (1982, 1983, and 1990). Studying the terrace deposits of the major rivers flowing to the Ionian coast of Basilicata, he found there have been four phases of erosion in the region during the Holocene: the first in the late Pleistocene/early Holocene, the second from round 700 BC to AD 200, the third from the eighth century to the eleventh/twelfth or fourteenth/fifteenth centuries, and the fourth during the nineteenth and early twentieth centuries. The first phase he ascribed to climatic and/or eustatic causes, but he found that human action had subsequently multiplied rates of erosion in the region and that all three subsequent phases were caused by humankind. Brückner's second phase, suggesting a classical phase of erosion caused by farming and clearance, was supported by Neboit (1977) who suggested that the extensive valley-bottom alluvial deposits dating from that time were produced by deforestation and agricultural/pastoral expansion during Greek colonization. In this erosion phase up to 12 m of sediment was deposited at Brückner's study sites.

Siltation due to soil erosion was probably the cause of the spread of malaria across the coastal plains of Basilicata. This had begun by the third century BC according to Alexander (1985), or by at least 65 BC according to Ciasca (1928). By the first century AD all of Basilicata's Ionian coast was infected with malaria. Although erosion probably began to slow during the economic decline which marked the end of the Western Roman Empire, the inferential evidence on malaria implies that it continued during the medieval period, and this is confirmed by Brückner (1982, and 1983). In the period between AD 800 and (depending on location) the eleventh/twelfth or the fourteenth/fifteenth centuries, he found between 1.5 and 3.0 m of sediment was deposited at his study sites. Similarly, in Treia, Marche region, rates of surface lowering rose from their pre-Roman estimated figure of 2 to 3 cm per 1,000 years to a post-Roman figure of 100 cm per 1,000 years (Alexander, 1985).

Extensive alluviation continued during the medieval period, having become particularly severe after AD 550 (Ciasca, 1928). Monticelli (1841, 2, translated) estimated that almost four-fifths of Basilicata's coastline was malarial and "Most of today's unhealthy areas were in ancient times very healthy, or at least not unhealthy" and that most of this change had occurred by the eleventh century.

The first documentary evidence from Basilicata of landslides comes from the sixteenth century (Almagià, 1910; Boenzi, 1974; Regione Basilicata, 1987). It is difficult to provide estimates of the extent of the problem, but it must have been reasonably widespread because Racioppi (1902) noted that trade in Basilicata at that time was made particularly difficult in the winter as the roads were often damaged - presumably by landslides.

By the nineteenth century, a growing pressure of population on the land had led to renewed land degradation - particularly as a result of contemporary deforestation and agricultural changes. Afan de Rivera (1832, 226, translated) noted that "the valleys and plains are almost everywhere subject to the infection of stagnant water". This process has continued during the twentieth century, giving rise to the fourth period of alluviation identified by Brückner. Erosion has been reduced by regional soil conservation programmes and for the first time in several thousand years, the sea has started to encroach on the Ionian coast (Regione Basilicata, 1987).

The prolonged periods of erosion accelerated by humankind experienced in Basilicata have not been continuous, but their significance nevertheless demonstrates the commanding role which humankind has come to have over slope instability in the region during the last several millenia. Although recent soil conservation programmes have begun to reduce erosion, their effectiveness must be balanced against the cumulative effects of deforestation, agriculture, urbanization, and industrialization.

4.3.1.2 Deforestation

Neolithic people reached Southeast Italy by about 5000 BC, and by about 4000 BC they were farming. This demanded a sedentary way of life, and caused a revolution in the intensive use of the land - though it was mainly practised in the lowlands. Brückner (1983) found relatively low levels of erosion in the period from 4150 BC to 1400 BC which implies that the first agriculture did not lead to a significant acceleration of land degradation across the region - either as a result of its small scale or its low impact.

The extent of woodlands during the classical period in Italy is not certain, but a large number of contemporary references were made to woodlands subsequently lost to agriculture in areas such as Basilicata (see Darby, 1956). A number of writers described the decline of the forest, and some areas such as Campania had already experienced considerable deforestation by the end of the Western Roman Empire in the fifth century (Simmons, 1989). Those forests which remained by the end of the classical period were mainly in the mountains (Darby, 1956).

Information on deforestation during the medieval period is limited, but it is known that severe damage had already been done to the forests throughout Southern Italy by the modern period. In the Kingdom of Naples in the first half of the eighteenth century there were 105 million hectares of cultivated land, 35 million ha of pasture and woodland, and 42 million ha of uncultivated land (see Izzo, 1976). The greatest concentration of woodland was in the regions of Calabria, Abruzzo, and Basilicata.

A further period of deforestation had begun by the nineteenth century. Estimates vary of the wooded area that has covered Basilicata in the past, though undoubtedly there was extensive deforestation during the nineteenth century (see Puglisi, 1977). In 1908 Nitti claimed that "very much more" than 200,000 ha had been deforested since 1860. La Cava estimated that 137,000 ha had been deforested in the period 1877 to 1903: though Vöchting suggested that the figure was 170,000 ha - with the major losses coming after 1887. The probably reliable estimate of Rossi-Doria (1963) suggested that woodland covered about 290,000 ha in 1800, 240,000 ha in 1860, 180,000 ha in 1908, 126,000 ha in 1930, rising to 169,000 ha in 1962.

The spread of capitalism into Basilicata by the nineteenth century, coupled with the rapid rise in population, led to an even more extensive deforestation associated with agricultural expansion. Deforestation was encouraged by the release of clerical lands, the growth of the railways - which acted as consumers of wood and the vanguard of industrialization - and freer forestry regulations. Zuccagni-Orlandini (1844, 461, translated) described the problem as follows: "Almost all the mountainous slopes, lowered by floods and other physical causes, sent their detritus down their waters to form deposits in the lowlands: not a few of these heights have become uncultivated and naked because of the intemperance of deforestation."

The growing use of the forest led to overexploitation and an increasing danger from landslides: "As consequences of the long lasting extensive use of the forest (i.e. pasture, charcoal burning, fires) and the active deforestation (i.e. clearing) must be considered the destructive landslips (franae [sic]) of various scale [sic] and manifold forms, particularly in the flysch mountains and Pliocene hills with clay soils." (Tichy, 1957, 288.). D'Errico described the results in detail as they affected Basilicata on the eve of the disastrous December 1857 earthquake (1865, 34, translated):

> This was the state of things at the end of 1857: the population involved exclusively in agriculture, and lured by bumper crops, unwisely cut down the woodlands, taking cultivation right up to the highest mountain summits: this was the deplorable cause of disasters which were to force misery on many areas. The disruption of the wooded slopes led to earthslips and landslides: on the high summits of the Apennines the snow rapidly melted with the first warmth of spring, and the waters discharged furiously through the glens and gulleys, dissipating themselves in the growing torrentbeds and riverbeds, causing immense damage to the adjacent land.

The development of capitalism in the region was accompanied and eased by a revolution in the tenure of forests (table 4.8). The abolition of feudalism led to the dismemberment of feudal forests and, although a large proportion of the woodlands was protected by the state or placed in commons, a significant proportion was sold off. The proportion increased as the century progressed, with the dissolution of the commons.

Table 4.8 Basilicata: changes in forest tenure from 1809 to 1870 (source: Tichy, 1962)

In 1809:	
Feudal forest	35.7%
Common forest	30.6%
Royal forest	23.0%
Private nobles' forest	6.3%
Church forest	3.0%
Private forest	1.4%
In 1870:	
State forest	11.4%
Common forest	54.0%
Private forest	34.6%

Deforestation raised widespread popular discontent among both the educated and the uneducated. Afan de Rivera (1832, II, 483, translated) had warned that the damage already done by deforestation was "against the design of creation". And D'Errico (1865, 147, translated) went on to argue that "it is undoubtedly the case that the fatal destruction of the woods being carried out could lead to a serious and profound damage to the population, enterprise, and the future prosperity of the region".

The behaviour of the peasants over deforestation demonstrated an understandable complexity. They were partly responsible for deforestation, but many were also aware of the destructive effects of the action which poverty forced on them. In an unsympathetic account of deforestation in Calabria and Basilicata, N Douglas (1915, 218) described the behaviour as follows:

> To denude slopes in the moist climate and deep soils of England entails no risk; in this country it is the beginning of the end. And herein lies the ineptitude of the Italian [forestry] regulations, which entrust the collective wisdom of rapacious farmers with measures of this kind, taking no account of the destructively utilitarian character of the native mind, of that canniness which overlooks a distant profit in its eagerness to grasp the present - that beast avarice which Horace recognized as the root of all evil. As if provisions like this of the "vincolo forestale" were ever carried out! Peasants naturally prefer to burn the wood in their own chimneys or to sell it; and if a landslide then crashes down, wrecking houses and vineyards - let the government compensate the victims!

Sections of the poor seem to have been just as vociferous in their complaints as the educated. Having travelled around Basilicata in the first decade of this century, Nitti noted that "Everywhere proprietors and peasants said that the ruining of the woods has been their ruin. Not a soul disagreed." (Nitti, 1968, 63, translated). And Azimonti (1921, 48, translated) recorded that "The people living in the mountains make it plain that they are aware that their immediate needs should be reconciled with the inevitable needs for land reclamation... for the *restoration of the mountains.*"

The increase in the forested area during the twentieth century was originally begun by the Fascist government, which introduced a programme of land reclamation and reforestation in the 1920s (Ciasca, 1928; Mercandino and Mercandino, 1976) and gave limited protection to woodland in 1923. However, it was only under the post-war state that the centuries-long decline in the area of woodlands was reversed, particularly through the agency of the Cassa per il Mezzogiorno. Although many old woodlands continue to be destroyed, 800 reforestation projects have been undertaken, affecting a total of 40,900 ha. The total planted peaked in the early 1970s (table 4.9).

Table 4.9: Basilicata: reforestation from 1950 to 1980 (source: *Il dissesto idrogeologico della Basilicata*, 1984)

1950-1955:	1,500 ha
1956-1960:	5,250 ha
1961-1965:	10,300 ha
1966-1970:	8,450 ha
1971-1975:	11,400 ha
1976-1980:	4,000 ha

The quality of the wooded area of the region remains generally poor. Of the forested area in 1962, about 50,000 ha were defined by Rossi-Doria (ibid, translated) as "heavily degraded". Similarly, in 1980, 65,295 out of the total 224,164 wooded hectares were defined as in poor condition (*Il dissesto idrogeologico della Basilicata*). Yet despite problems of fire (which destroys between about 0.6% and 2.5% of the forested area each year, according to Rendell, 1986) the wooded area of Basilicata had increased to 224,164 ha, (22.4% of the region's area) by 1980. Although this growth goes some way towards repairing the decline of the last century, it is still significantly below the 290,000 ha of woodland in 1800.

4.3.1.3 Agriculture

The demands placed on the land are proportional to the population and its consumption of resources. Basilicata's population has grown slowly over the past two thousand years (particularly so in comparison to the whole of Italy) because the region has been affected by poverty and high emigration. However, consumption per person has increased very quickly since the last war with the rapid, if partial, integration of the region into modern industrialized society.

For some periods, little is known about the number, growth, and concentration of Basilicata's population. However, there is a reasonably detailed knowledge about the population of Italy as a whole (McEvedy and Jones, 1978), which give an approximate guide (figure 4.7).

The first population figures for Basilicata come from Racioppi's estimates (Sebastiani and Sebastiani, 1979). He calculated that by 250 BC the population of the Lucani (who occupied most of present-day Basilicata) was between 200,000 and 250,000. In 1277 the population of Basilicata was about 100,000. It fluctuated greatly, reaching about 152,000 in 1669, 491,000 in 1901, and 590,000 in 1981 (Istituto Centrale della Statistica, 1984 a and b) (see figure 4.8).

Although agriculture had begun in Southern Italy by 4000 BC the first intensive agriculture was introduced by the colonial expansion of the Etruscans, Greeks, and later the Romans (Almagià, 1959). This colonial agriculture was run on a commercial basis and in Basilicata was particularly intensive around the Greek colonies of the Ionian coast. By the first century BC, it was serviced by a relatively sophisticated money economy (Heichelheim, 1956). Basilicata became a major exporter of wine, olives, and wheat: first to Greece, and later to Rome (Burato, 1976).

In practice, the demands on the land were such that its productive capacity declined during the classical period. Under Roman rule, according to Ciasca (1928, 25, translated), Basilicata's land was "sacrificed" to Rome. Much of the land, particularly on the large slave estates, was "undermanaged and overtilled" (Alexander, 1985, 123). Some experiments in management were carried out but a combination of light cross-ploughing and no rotation caused soil exhaustion. Dauberry (1857) recorded that soil exhaustion was considered inevitable and unavoidable - the land was popularly believed to be worn out by cultivation like a woman worn out by childbirth.

From the third century AD significant decline began in the Roman economy. Trade and banking went into recession, and agricultural land began to be abandoned. Many of the large estates were let to peasants for subsistence farming which came to replace market farming (Heichelheim, 1956). By the fourth century AD large tracts of

Figure 4.7 Italy: population

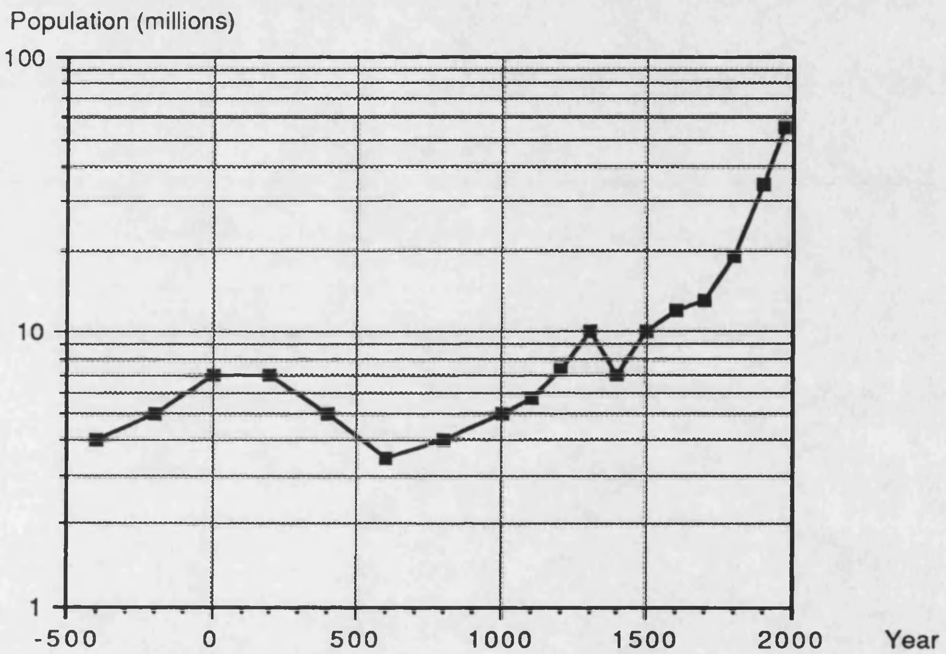
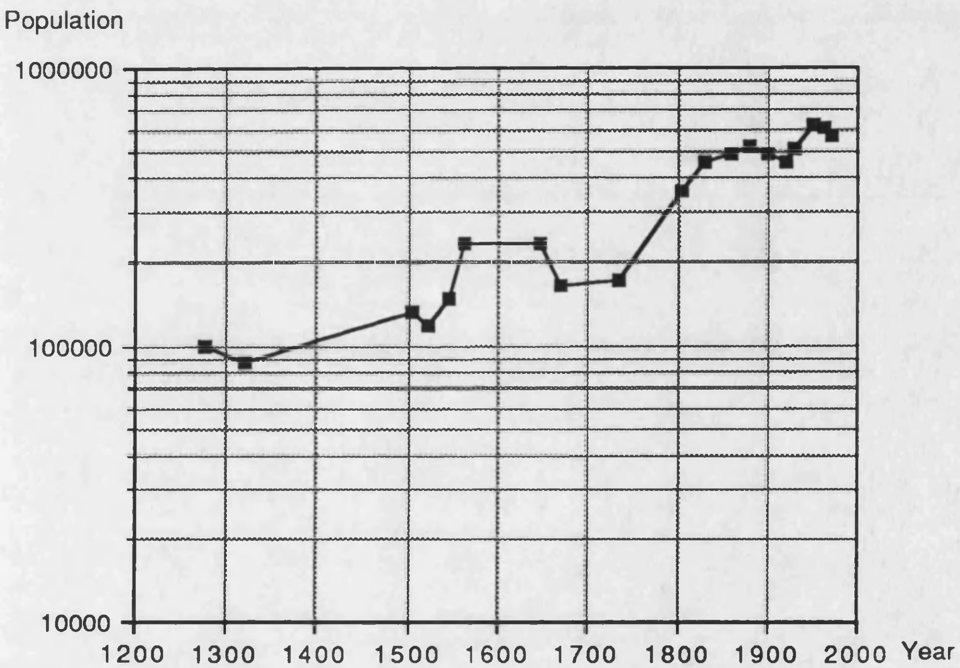


Figure 4.8 Basilicata: population



Campania were already deserted (Darby, 1956); and by the fifth century the countryside of Southern Italy had begun to take on its medieval appearance with large areas depopulated, declining cities, and subsistence farmers isolated from the wider market. By the sixth century some abandoned land had reverted to scrub and forest (Thirgood, 1981); and invasions and economic decline accelerated depopulation, abandonment, and degradation of former agricultural land.

The original tenure of the big estates which covered much of Basilicata had been slave labour. This came to be supplemented by serf labour from the fourth century when the poor were forced to place themselves under the power of their landholders (Evoli, 1931) and feudalism was generally established by the seventh century. Almost all the slaves were freed by the tenth century, and the serfs themselves began to be freed from the twelfth century onwards (Burato, 1976).

Cultivation under feudalism had a generally detrimental effect on the land, according to Evoli (1931, 206, translated), the landed nobility was assured of a high income "without the need to put themselves out to ensure that the land they had abandoned to the peasants should be fertile". Feudal contracts contained requirements for protection of the land (De Stefano and Lombardi, 1976) but, as Evoli (1931) made clear, the net effect of feudalism was the marginalization of farmers, and their alienation from their own land. Not only did absentee landlords frequently take short-term receipts at the expense of longterm sustainability, but the tenant, fearful of wasting labour, "limited himself to strip [the land] as if it were a subject" (ibid, 214, translated).

The medieval period was characterized by relative technical stagnation in agriculture, as Burato (1976) made clear, but some progress was made. There were some clearances and a limited number of soil conservation measures, such as drainage and irrigation, were carried out across Italy - but according to Almagià (1959) these were mainly confined to the North (under the new municipalities and some religious orders) and Sicily (under the Arabs). From the thirteenth century, agricultural production - and with it the population - once again began to decline (Burato, 1976). This was perhaps because of the greater frequency of cooler, wetter weather (Flohn and Fantechi, 1984). In Northern Italy, grain prices rose, reflecting scarcity, from around 6 Dutch Guilders for 100 kg in the early 1500s to over 15 Dutch Guilders in 1600.

The dislocation caused by economic and demographic decline led to widespread unemployment, abandonment of land, and further land degradation (Boenzi, 1974).

Settlements were abandoned, and the population fled to the uplands: in 1268 there were 150 settlements in Basilicata, but by 1445 the number had shrunk to 96 - possibly for reasons of defence, health, or to enable patriarchal control of the family (Banfield, 1958; Blok, 1969; Ranieri, 1972). The dispersion of population has only recurred since the nineteenth century (Dickinson, 1956).

The abandonment of land and its subsequent degradation was worsened by the stagnation of feudalism after the Kingdom of Naples' Norman rulers. The power of the barons grew, and with it the expansion of the baronial forests and pasturage. Although protecting some of the countryside, these trends placed an even greater strain on the small areas of productive land and, as Slicher Van Bath (1963) noted, the agricultural system was ill-suited to increasing production. The result was greater soil erosion and more landslides. On the Ionian coast, deposition led to the growth of malarial marshland and whole areas of the coast were abandoned - most notably around Metaponto (Sebastiani and Sebastiani, 1979).

The stifling strength of feudal power, combined with rural poverty, prevented the accumulation of capital, and capitalism was slow to develop in Basilicata (Evoli, 1931). By the beginning of the eighteenth century the nobility and church together owned 75% of the land in the Kingdom of Naples: but their social supremacy was increasingly under threat by the rise of the bourgeoisie (Izzo, 1976). The development of capitalism, slow though it was, seems to have been a major factor in the reversal of agricultural decline from the end of the seventeenth century - but the cause of new strains on the environment too.

The most significant changes to the environment came about through the development of agriculture in the eighteenth century. Nobles began to return to manage their own land, and improvements were increasingly made in production methods. Output grew slowly, but not enough to feed the growing population. Monticelli (1841, 48, note 8, translated) described the results:

> The government of Charles III and the peace enjoyed from 1744 to... [1790] caused a considerable growth of our population which, forced by the needs for greater subsistence, increased agricultural production, not only without taking care to increase pasturage but indeed doing it damage. The mountains were deforested to get a scandalous profit from the wood, and virgin land from the woods which - in the early years - gave a very good return.

While the population grew, the threat of starvation increased the pressure on the environment. Galanti (1794, 197, translated) noted that in areas such as Basilicata, "the fertility of the country is... in contrast with the poverty of the inhabitants". The situation alluded to in the Gaudioso Report of 1736 was of a most degrading poverty, as described by Pedio (1965, 15, translated):

> peasants wasted away and starving, aged before their time, tormented by malaria and forced to overwork a sterile land... women who carried, engraved into the face, the signs of the most frightful poverty; priests who lived in a way wholly beneath their social standing; a few gentry, who were distinguished from the lowest only because the lowest considered them superior; a few lawyers and doctors, morally and materially degraded...

The price of food rose significantly: according to Macry's figures (1974), by 75% between 1734 and 1800. Cultivation expanded into more vulnerable environments: by the mid-eighteenth century around the city of Matera, for instance, the steep hills were already used for cereal production (Baldassare, Boenzi, and Loiaccono, 1976). Macry noted that "the woods were destroyed, pasturage reduced, and the possibility of selling grain at a high price led to the introduction of wheat... despite the fact that the cultivation of wheat sterilizes the ground..." (Cited by Izzo, 1976, 257, translated.) As Izzo commented, starvation forced the poor to destroy the land: "For their own survival, those who had sought refuge on the mountains were forced to sacrifice the woodland for grain" (ibid, 246, translated).

With the end of feudalism large parts of the region, previously subject to feudal controls and a degree of protection from over-exploitation, were given over to private landholders - almost exclusively to the bigger landholders (De Stefano and Lombardi, 1976). According to Boenzi (1974, 289, translated) the municipalities "were not always able to control the use of the woodlands" which they received, while the new private landholders "tended to put as much land as possible into cultivation". During the nineteenth century, grain production continued to increase at the expense of meadow, and the forested areas were reduced further - notably on the big estates (see Baldassare, Boenzi, and Loiacono, 1976).

When national unification came, the benefits went primarily to the rising rural bourgeoisie, with the peasants becoming increasingly impoverished. The development of capitalism in Basilicata, slow though it was in national terms, meant that changes like the abolition of internal tariffs gave very little advantage to agriculture. Church lands, accounting for just under 8% of the cultivated land in the South, were sold off between 1864 and 1900 - which increased the area of land deforested. Payback rates for the land were high enough to impoverish many peasants, and further encourage the transference of land to big landholders.

Agriculture entered a crisis at the end of the nineteenth century as regional problems were compounded by falling world prices, the spread of new diseases such as phylloxera, and a tariff war with France. Production declined, land was abandoned, and emigration increased rapidly. The number of people leaving the South for abroad rose from 22,000 in 1880 to 401,000 in 1913. Technical changes such as the substitution of rotation for fallowing were used increasingly, particularly under the influence of the new capitalist farms and improving education. According to De Stefano and Lombardi (1976) the last half of the nineteenth century saw a reduction in the area of woodlands and meadows, with an increase in the area covered by tree crops and a slow increase in the area under grain (table 4.10).

Table 4.10: Southern Italy: landuse from 1861 to 1970 (source: De Stefano and Lombardi, 1976)

Landuse	grain	tree crops	meadows	woods and pastures	uncultivated	other
1861	44.6	7.0	25.7	15.0	7.7	-
1929	45.6	13.8	22.8	10.9	6.9	-
1970	35.8	17.3	26.1	13.6	-	7.2

Throughout the twentieth century agriculture in Southern Italy remained poor in relation to that of the North. The return per hectare of land was among the lowest in the country: on the plains in Basilicata it was L119, compared to an average of L762 in Piedmont; in the mountains it was L97 in Basilicata, compared to L228 in the mountains of Liguria (ibid). After the first world war, conditions deteriorated further. Postwar protectionism led to agricultural exports falling by 93% between 1913 and 1924. Similarly, migration controls meant that emigration fell by 98%. From 1925, devaluation of the lira, to favour manufacturing industry, led to a fall in agricultural prices and widespread unemployment.

In 1924, nearly half of Italy's balance-of-payments deficit came from grain imports and the government declared the "Battle for Grain", in order to overcome the problem (Mercandini and Mercandini, 1976; King, 1987). Grain prices were raised above world market levels in order to increase production, principally to the benefit of the market-oriented farms in the North (De Stefano and Lombardi, 1976). Although the Battle for Grain had only a relatively small effect on the agriculture of Southern Italy, changes continued on the land. There was a reduction in the number of workers on the land and an expansion of intensive cashcrop production. In Basilicata the growth in the population was heightened by the effects of anti-migration laws abroad and the growing pressure of the land led to a greater fragmentation of landholdings (Camera dei Deputati, 1954; Davis, 1973). There was a desperate expansion of production in Basilicata, principally on marginal land, vulnerable to degradation (Baldassare, Boenzi, and Loiacono, 1976).

Since the last world war, there have been fundamental changes in agriculture in Basilicata, encouraged by rapid economic growth. Modern agriculture in the South of Italy, and particularly in areas such as the Ionian coastal plains of Basilicata, has become increasingly capital-intensive. It is characterized by a growing mechanization, specialization, and concentration, while some areas are being abandoned entirely as a result of rural exodus (Baldassare, Boenzi, and Loiacono, 1976; De Stefano and Lombardi, 1976; King, 1987). As King (1987) noted, agriculture has consequently changed in character from a "'refugee sector' for those unable to find work" (page 42) to a more developed sector - though still less modernized than that in most other European countries (page 54).

Six land reform agencies were established in Italy after the war with the dual purpose of reducing political protest over land tenure and redistributing the land in order to ensure the existence of smallscale agricultural capitalism in the future (King, 1987). Land reform aimed to address the very unequal distribution of land - in 1947 the major 0.2% of landowners in Italy owned 26.4% of the land. Eventually 28% of the country's land was requisitioned (four-fifths of which was in the South), and 618,000 ha were assigned to 113,000 families. The Ente di Riforma Puglia-Lucania-Molise (which includes Basilicata) had requisitioned 200,000 ha by the 1970s.

The structure of land tenure has undergone a significant change, with a decline in the importance of the big landowners, and a growth in medium-sized farms. Although control over the land is fragmented, the increasing influence of the European Community, the state, and agribusiness has ensured new investment (Boenzi, 1974; King, 1987) - but this intensification of agriculture has had a significant impact on land degradation and the number of landslides because, according to Chisci (1979, 248, translated), it has been carried out without "an adequate programme of mechanical and biological protection for slopes".

A number of sources back Chisci's claims. In research carried out in the Central Apennines, he himself (1986) found that the new agricultural techniques had caused a significant increase in landslides since the 1950s. Field levelling (to allow mechanization) had become common, up-and-down tillage had been "largely adopted" (page 7), forage crops had been reduced, and mechanical structures for regulating waterflow and soil erosion had been reduced. Although less labour was devoted to land (between 1954 and 1976 the number of hours devoted to each hectare of vineyard fell by 60%) the proportion of time devoted to soil conservation fell even faster. In 1954, 10% of labour had been used on water and erosion control: in 1976 the figure had fallen to only 3%.

There is widespread evidence of the impact of these processes on landsliding. Insufficient drainage, and field-levelling to allow the extension of vineyards led to an 86.8% rise in the area affected by landslides in a part of Tuscany studied by Canuti, Garzonio, and Rodolfi (1979). In Calciano (Basilicata) Alexander (1990) found that deforestation of 77 ha of land in the 1960s has provoked a 125,000 m^3 flowslide. And in the Orco-Sativo basin of Vaglio Basilicata, more intensive cultivation and deeper ploughing was probably the cause of greater gulley flow, and the development of mudflows and debris flowslides - which in turn caused further abandonment of the land.

4.3.1.4 Urbanization

Settlement and its associated infrastructure has affected the landslide hazard in Basilicata in two main ways: the location of settlements has been an important element in their vulnerability, and construction work has disrupted slopes throughout the region.

The location of settlements in Basilicata is often a vulnerable one, with many towns located on hillslopes. Following the definitions given by Franciosa (1951) 28 (that is, 21%) of the town centres can be defined as located on hilltops, 86 (66%) as located on hillslopes, and only 17 (13%) on plains (figure 4.9). Many of these sites are vulnerable because of a combination of relief and geology: this is particularly the case for the settlements such as Grassano which are located in the Bradano Trough with its friable geology and steep slopes. Cotecchia (1957, 9, translated) described such towns as "almost without exception at some altitude, close to very steep slopes and, in particular, at the zone of transition between the clays and the sands". Consequently only 18% of the 131 towns in the region are located on stable geological formations, and the vulnerability of many of the settlements has been made worse by erosion.

Figure 4.9 Basilicata: settlement sites (source: Franciosa, 1951)

The statistical findings of Carrara and others (1978) give further evidence of the impact of construction on slopes, though their findings showed considerable ambiguity in the relationship between specific cultural artefacts and the intensity of slope instability (to which they gave a points score, with a high score indicating high instability), probably as the result of spurious correlation. Villages tended to be most closely associated with areas of relatively high stability - but consolidation measures were most closely associated with areas of low stability (table 4.11).

Table 4.11: Ferro Basin: artefacts and slope instability (source: Carrara and others, 1978)

Artefact	*Instability score* <10	10-16	16-23	23-32.6	*total*
none	17.4	9.5	36.3	36.8	100
main roads	26.0	10.2	43.1	20.7	100
secondary roads	10.7	6.7	68.0	14.7	100
pipelines	36.1	14.5	37.3	12.0	100
consolidation	14.7	2.9	29.4	52.9	100
country houses	12.1	7.4	46.2	34.2	100
villages	33.3	9.5	47.6	9.5	100
mean	17.5	9.1	40.1	33.3	100

Regione Basilicata (1987) reported that settlements in the region have caused landslides in a number of ways, the most frequent being: unwise (and often illegal) urban development on vulnerable land, saturation of slopes through leakage from water and sewage pipes, oversteepening of slopes by excavation, inadequate consolidation against landslides, and the abandonment of agricultural land on the outskirts of towns. Carrara and others (1978) attributed 2% of the landslides that they analyzed to "human activities" (by which they meant direct activities). Alexander (1981) documented that some landslides after the 1980 earthquake were reportedly caused by fractured drains.

The effects of building have been multiplied by the rapid rebuilding programme partly financed by the government since the 1980 earthquake. During the 1980s a total of over L2,000 billion was spent on repairing earthquake damage and slope instability affecting over fifty settlements in the region (Regione Basilicata, 1987). Of this huge sum over 90% was to be spent on reconstruction following the 1980 earthquake; on new, more stable urban developments; and on the protection of urban areas.

4.3.1.5 Industrialization

Industrialization has led to a transformation of Basilicata and its society, and the development of new, urban social relations with the land. Its development throughout Southern Italy has been a slow process, hampered because unification allowed it to be dominated by the competitiveness of Northern industry (King, 1987). In addition Basilicata's isolation has long held back industrial development, and Macry (1974) described the region in the nineteenth century as characterized by relative isolation from Naples and the lack of a local market. The region's first metalled road had only been built in 1792 (Racioppi, 1902).

Even though it was short-lived, early industrial development in Basilicata further contributed to deforestation. For example, charcoal-burning and ironworking - especially near Lagonegro, Spinoso, and Sarconi - destroyed a large proportion of the neighbouring woodland (Racioppi, 1902; Tichy, 1957).

Industrialization in Basilicata was mainly the result of postwar moves to integrate the South into the national economy. In Basilicata it accelerated with particular rapidity during the 1960s: though industrial concerns have been damaged by the recession of the 1980s (Mannella, 1985). Between 1951 and 1981 the proportion of the working population employed in agriculture fell from 73% to 31%, in industry it rose from 15% to 27%, and in services from 12% to 42%. Although industry is limited by a local scarcity of resources and capital in the region, and much remains based on undercapitalized artizan production, Basilicata has changed from a rural to an urban society within the past forty years.

4.3.2 Direct impacts on the land

Following Gutkind (1956, 12) the approach to the land in Basilicata can be seen as characterized by a change from a "hesitant and whispered dialogue between man and nature" to an "aggressive and loud exploitation". The change can be seen in the history of the struggle against landslides - a history which has been conditioned by the institutions and practices developed to manage the land.

Although the very earliest societies had the ability to change the land, this ability was rarely exploited. The roots of this inaction lie partly in social and technological impotence, but also in the ideology of an external, dominating nature (N Smith, 1990). This premodern approach has continued in the popular consciousness in regions such as Basilicata. For example, according to Cornelisen (1969, 15) in Basilicata hazards such as landslides "are understood to be God's punishment for sins committed". According to Banfield (1958, 112) many people in Basilicata then looked "to the saints and to God to ward off calamity". The persistence of this faith in Basilicata has been widely documented (De Martino, 1987; Lucano, 1983; Bronzini, 1984). Levi (1982, 79) described its effects on the peasants of Basilicata in the 1930s:

> They live submerged in a world that rolls on independent of their will, where there can be neither happiness, as literary devotees of the land conceive it, nor hope, because the two are adjuncts of personality and here there is only the grim passivity of a sorrowful Nature. But they have a lively human feeling for the common fate of mankind and its common acceptance.

Following from the hesitant approach of premodern societies to the land, early attempts to control the problem of soil degradation and landslides in Basilicata were limited by a restricted understanding of the problem, and low levels of technology. The subsistence ethic ensured that some soil-conservation techniques were carried out, such as the disruption of rill-erosion (Kayser, 1956; Molfese, 1978). The significance of the protection given by these works in such a hostile environment should not be underestimated: Braudel (1972-1973, I, 243) commented that "In the Mediterranean the soil dies if it is not protected by crops... It is a miracle if it is ever preserved or reconstituted by the labour of peasants." However, there was no miracle. The longstanding marginalization of the peasantry led to land degradation.

Some organized soil conservation programmes were undertaken in Italy during the medieval period - but these had little impact in Basilicata (Ciasca, 1928). Against the increasingly evident signs of land degradation the government of Basilicata, particularly under Spanish rule, acted fitfully and ineffectively to conserve the soil. This ineffectiveness was only slowly reversed - a development which can be seen to have begun with the disastrous famine of 1764 that damaged the government by exposing significant weaknesses in the economy. From the late eighteenth century, writers in the Kingdom of Naples began to interest themselves in the need for social change to reverse environmental degradation and laws were passed to conserve the woodlands, and to reforest landslides. However, the works carried out were too little and too late, and they remained largely ineffectual - particularly because of a lack of policing.

Feudalism was abolished in 1806 by the French, who had then occupied the Kingdom. Much more was spent on the country's infrastructure (for example the Corps of Bridge and Road Engineers was increased from fifteen employees to forty-four), but the return of Bourbon rule in 1815 led to retrenchment. Soil conservation measures were reduced: in 1818, for example, the municipalities spent a total of 830,000 Ducats on all public works but the government's spending on land reclamation and soil conservation fell, from D600,000 in 1816 to D240,000 in the middle of the century.

By the mid-nineteenth century the Neapolitan government was forced to reconsider its approach to soil conservation, described in an 1855 report by the corps of water and road engineers as of utmost urgency. After the 1855 law on land reclamation and soil conservation slow progress was made in the introduction of new technology such as windmills, but only one programme was started under that law and the money provided for the maintenance of all government schemes continued to be insufficient.

Southern Italy remained essentially untouched by the laws on land reclamation and soil conservation under the new unified state. The law on land reclamation of 20 March 1865 committed the state to contribute to reclamation where it was of "national" importance, or beyond the resources of the local municipalities. From the 1880s a number of laws were brought in to promote specific aspects of land reclamation, such as the Baccarini law for the reclamation of the marshlands (law of 23 June 1882), and to improve internal navigation (law of 2 January 1910). Under the Baccarini law the state began to contribute 50% of the cost of those projects for which health was the primary consideration but there was a significant Northern bias in spending. By 1915 while the proportion of soil conservation carried out in the South was only 0.4% of that designated for eventual conservation, while in the North it was 33.9% (De Stefano and Lombardi, 1976).

The first major government programme for consolidation against landslides in Basilicata came after the Zanardelli inquiry with law number 293 of 1904 (Regione Basilicata, 1987). The programme was to last twenty-one years, but projects were slow to materialize and some were cancelled (Zanotti-Bianco, 1926). It was only from the advent of the Fascist government that the rate of land reclamation was accelerated, but the government concentrated on the more spectacular lowland drainage schemes while neglecting watershed management and erosion control (King, 1987).

In 1928 the Mussolini law gave adequate funding for land reclamation and soil conservation for the first time (De Stefano and Lombardi, 1976). And in 1933, the Serpieri law reaffirmed the need for soil conservation and reclamation to take into account soil, drainage, health, and colonization. Six land-reclamation agencies were set up, which today oversee 61% of Basilicata (Unione Regionale dei Consorzi di Bonifica della Basilicata, 1978). The work of the agencies, notably drainage and (initially limited) reforestation, included implementing management strategies designed to reduce landsliding. Little was done in Basilicata, and by the end of the war although 71.1% of the projected reclamation projects had begun only 0.3% had been completed.

Government has increasingly intervened in soil conservation since the last world war. This intervention was conceived as, according to a number of commentators such as Sassoon (1986, 39), as "an instrument of social control" to prevent the growth of the Communist Party, ensure the electoral basis of the Christian Democratic Party, and to provide private enterprise with favourable conditions for growth.

The Cassa per il Mezzogiorno was a major element in this intervention in Basilicata and has carried out extensive land reclamation projects (*Il dissesto idrogeologico della Basilicata*). Throughout Southern Italy the Cassa spent L500 billion between 1950 and 1980 (in addition to the sums spent under the Special Law for Calabria) of which: 6% was spent on consolidating 22,000 ha of land against landslides; and 46% was spent on watercourses, 43% was spent on 150,000 ha of forestry projects, and 5% was spent on irrigating 20,000 ha of agricultural land. Of the L500 billion, L75 billion were spent in Basilicata: L46.5 billion on reforestation and the reconstruction of landslide-prone land, L27 billion on watercourses, and L1.5 billion on irrigation.

Since the 1970s the growing scare over the threat posed by landslides in Italy has led to a significant increase on spending on their prevention. This change can be traced back to a ministerial proposal made in 1971 (never acted on) to spend L10 trillion on landslides nationwide during the remainder of the century. This was designed in addition to the L3 trillion which had already been allocated for the 1980s. After the widespread floods of 1973 the government invested heavily in protection against landslides as part of soil conservation: law number 731 of 1973 led to investment in engineering works, which has continued to the present day with total costs coming to L60 billion by the mid 1980s (Lazzari, 1986b). Spending on intervention against landslides and earthquakes totalled L150 billion between 1973 and 1986.

The central government's spending on landslides in Basilicata increased significantly during the 1980s. This increase was produced by a combination of: a L60-billion research project funded in 1975 to analyze the problem of slope instability in the region (which had begun to uncover significant problems by the end of the 1970s), the international publicity of the 1980 earthquake, and the dramatic impact of the death of seven in a landslide at Senise in 1986. By 1987, 116 of the total 131 towns were to be consolidated against landslides (the figure includes 19 to be wholly or partly transferred). L122.5 billion was spent directly on consolidation against landslides: including drainage, engineering works, soil conservation, and reforestation projects. Most of this came after the Senise landslide - which brought a total of L200 billion from central government, to be spent on 26 settlements in the region (of which L108.5 billion was to be spent on the consolidation of 21 towns). In addition to the money from central government, the regional government had itself raised an additional L40 billion to be spent in the period 1986 to 1988, on additional consolidation against landslides in a number of towns deemed to have a less serious problem (figure 3.7).

This approach has not always been without its problems. One senior official of a government agency claimed, for instance, that in Basilicata the scarcity and crisis-orientation of funds and administrative energy precludes regular maintenance of facilities - which leads to further breakdowns in the retaining structures (anonymous interview). In a similar vein Alexander (1987, 1) criticized the bureaucratic inflexibilities which prevented a response to the warning signs of the 1982 Ancona (Marche) landslide. He described the event as "clearly the result of misunderstanding, and even gross negligence, on the part of those who might have been able to recognize the warning signs." Alexander found that the landslide was predictable, but ignored - either as a result of confusion, incompetence, or perhaps corruption.

Communities can benefit from the sporadic intervention of the bureaucracy. However, very often the involvement of the state has given an opportunity for improving the lot of vested interests, as chapter two indicated. The bureaucracy and politicians themselves benefit because vigorous, dramatic reconstruction allows a new start, a symbolic attack on the "stones that caused the hurt" (Binaghi-Olivari, 1981) and the revenge of culture on disobedient nature. In addition, demolition and construction have also often been linked with organized crime and fraud (Russo and Stajano, 1981).

In Italy, the state has almost completely taken over the management of important collective aims like the amelioration of hazards (Catalani, 1982). The result of intervention based on pragmatic political needs is that the attempts by the state to manage the environment have often been poorly planned and poorly executed, characterized by "the incapacity of public authority... the dominance of private over public interests, and cultural problems." (Mercandino and Mercandino, 1976, 358, translated.)

In addition to direct funding by the government, since the 1950s money has also come from the former Cassa per Opere Straordinarie di Pubblico Interesse nell'Italia Meridionale (the Cassa per il Mezzogiorno) - now reborn as the Azienda per la Promozione dello Sviluppo del Mezzogiorno. This organization was set up in 1950 and given its own budget to fund agricultural modernization in Southern Italy - subsequently its aims were extended to include promoting industrial modernization (Barberis, 1986; King, 1987). As part of its modernization scheme the Cassa per il Mezzogiorno was responsible for funding extensive land-reclamation programmes throughout Southern Italy.

The response to landslides is made through a variety of state agencies, the working of which has been examined by Alexander (1987). A number of these agencies have a role in combatting landslides affecting specific types of landuse. The historical contribution of these agencies to land reclamation in the municipality of Grassano is dealt with in chapter seven and in appendix C. The most important agency is the Genio Civile, the state Engineering Corps, which was founded in the early nineteenth century. Its work was at first limited to small works connected with bridges and roads, but after national unification it began to be involved directly in landslides (F. F., 1932; Morrone, 1987; Centini, 1987). The Genio Civile is responsible for all items of extraordinary expenditure in the construction and maintenance of public works, and also directs work carried out by agencies and local authorities or subcontracted to private companies. Most of the Genio Civile's operations (except for the water agency, the Servizio Idrografico) have been under the direction of the regions since 1972 (Morrone, 1987).

Regular maintenance against landslides depends on the aims and objectives of the respective agencies, but some work is also carried out by:

- The Azienda Autonoma delle Strade Statali (ANAS) which oversees major national roadways (Morrone, 1985).
- The Corpo Forestale, set up in 1877 to supervise the conservation and exploitation of woodlands (Morrone, 1986b). The Corpo Forestale is responsible for the protection of woodlands against overexploitation, erosion, and landslides.

• The Consorzi di Bonifica (land-reclamation agencies) set up from 1933 onwards (Morrone, 1986a). The Consorzi di Bonifica have been responsible for an upgrading of large areas of land across Southern Italy, and their work has included reforestation, and the protection of land against degradation and erosion.

• The Enti per Irrigazione (irrigation agencies) (see King, 1987). The Enti di Irrigazione have been responsible for the provision of irrigation water, and have required to protect watercourses against land degradation.

In Italy the role of the central state is complemented by the local state, which consists of twenty regions, divided into ninety provinces and over 8,000 municipalities (Presidency of the Council of Ministers Information and Copyright Service, 1976)*. The municipalities have a limited autonomy: they can represent the wishes of local people, but are restrained by the central state and by pressure from private organizations (Zink and others, 1957; Cappelleti, 1963).

According to Johnston (1989) the political parties, which compete for power within the state, can both respond to popular feelings about issues such as the environment and act to mould them as well. But their structure, which empowers them, also restricts the range of action which they can take. Political parties have traditionally had a remarkable strength in Italy (Sassoon, 1986), and are genuinely popular institutions - 6.5% of the adult population in Matera province belongs to a political party according to CENSIS (1986) but an imperfect democracy prevents them from always responding efficiently to people's needs.

One of the main hindrances to democracy in Italy is clientalism, the trading of political favours, and associated corruption. Most academics have described it as widespread in Southern Italy (Zuckerman, 1979; Chubb, 1982; Willey, 1984; Walston, 1988) and the recent *tangenti* scandal has begun to confirm even the wildest rumours. Corruption severely restricts the effectiveness and equity of the local state's power. Banfield (1958, footnote 5, page 95) cited the example of an American journalist's interview in the early 1950s with the mayor of Grottole. The mayor refused the journalist's parting gift with the explanation: "If I were to accept this gift which *I* understand, these people in the street would soon ask if there had not been more and how much I had kept for myself."

* The municipalities' main functions are local policing, public health, and planning. They are run by an elected municipal council (*consiglio comunale*), with a municipal giunta (*giunta municipale*) and a mayor (*sindaco*) who are elected by the council. Most municipal affairs, particularly in the smaller municipalities, are now dealt with or supervised by the mayor (Cappelletti, 1963).

Bureaucratic bottlenecks are perceived to make clientalism in politics not only desirable but necessary: "Italian party activists... are essentially political entrepreneurs... who use their party affiliations to open up a network of contacts in seeking resources for their communities." (Tarrow, 1977, 182.) This includes the manipulation of projects such as consolidation against landslides for clientalistic reasons. Willey noted that in Basilicata, the allocation of aid after the 1980 earthquake reflected the political skill of the administrators, and Walston (1988, 93) claimed that the aid available to Calabria after natural disasters has been "dispersed in ways which helped local notables rather than the homeless".

Such is the influence of corruption on the allocation of aid that, according to Alexander (1989b, 234), "Unevenness in government policy can be traced to the flux of national interest in disaster impacts; and more surely to the success or failure of local politicians of greater or lesser eminence to influence the national cabinet."

The effectiveness of the programmes used in Basilicata remains in doubt. Proponents of land-management programmes have pointed to their technical success in achieving specific goals for the reduction of hazards (Burton, Kates, and White, 1978). Their effectiveness in semi-arid environments was summarized by Lal (1990) who concluded (page 193): "Erosion control on agricultural land can be achieved by soil and crop management systems that ensure a good cover close to the ground surface... Slope gradient and length can be reduced by installing terraces or dams at intervals across the slope... Establishment and maintenance of good vegetative cover, however is the best way to control erosion."

Public policy of intervention against landslides was described by Lazzari (1986a) as aiming to use a flexible range of capital and organizational adjustments. Its key methods in the 1980s were:

- The completion and continued maintenance of all existing engineering works.
- Avoiding wherever possible "passive" defences such as retaining walls; and promoting in their place the use of "active" defences such as drainage works, canalization, and revegetation (which have the advantage of using local labour, upgrading the local environment, being cheaper, and being more effective for large tracts of land).
- Encouraging new housing developments on less vulnerable sites (if necessary away from the old urban centres) and ensuring their economic and social viability.

The techniques used for consolidation in Basilicata include:

• Reforestation, which has proved a popular option throughout the region. As Rendell (1986) indicated, some soils are simply too poor to allow tree growth - through reforestation using hardy local shrub vegetation can be a useful first step to land reclamation. Even when reforestation has been viable, it has often been carried out in an insensitive manner, and biodiversity has in many cases been harmed by the serried ranks of the fast-growing softwoods such as *Pinus radiata*.

• The use of check dams. Rendell showed that they are vulnerable to subsurface channelling, especially in dispersive clays. However, the Consorzio di Bonifica di Bradano e Metaponto (1972) claimed as evidence for the success of check dams in Basilicata that there has been: a decreased volume of transported material, and the grading of some of the less steep slopes; a reduction in erosion upstream of the check dams; and only 2% to 3% of the check dams installed between 1952 and 1972 were destroyed or severely damaged.

• Other techniques used include: the adoption of contour ploughing (which can be very effective if properly applied); the bulldozing of calanchi features (an expensive method, the efficiency of which it is difficult to assess); and the suppression of dispersive clays by the application of calcium hydroxide or humus (mulching is an old agricultural technique).

Rendell (1986) concluded that the success of these techniques was far from complete because of a lack of understanding of the very complex erosional processes at work, and because the aims of conservation have often been in conflict with the aims of agriculture. The effectiveness of consolidation on urban landslides was described as follows by Lazzari (1986b, 95, translated):

> In the majority of cases the interventions have had a theraputic effect on the places at the point of collapse or where there is an advanced state of degradation affecting a large part of a town. However, it has not always been possible to prevent all problems, and this has given rise to a second type of town when, by force of circumstances, conditions give rise to the frequent emergencies which have affected the entire [region's] territory.

In addition to the imperfect technical successes of soil conservation, many sources have suggested that the programmes act to foster state clientalism, the "culture of dependency". When the authorities grant a project the community "pays" by returning loyalty. Aid for the consolidation of landslides consequently acts to strengthen that which King (1981, 147) described as "the dependence of the underdeveloped South on the metropolitan, industrialized North" while preventing a "radical reordering of the economy and society of the region." In his analysis of events following landslides at Africo (Calabria), Stajano (1979, 188, translated) interviewed a local functionary who claimed that intervention to ameliorate landslides in his area is carried out for clientalistic, rather than technical reasons.

> "In our river basins, the forestry organization has worked only as a clientalist organization encouraging dependency, even though it seems there are many useful public works to be carried out here: retaining walls for the areas which slide after every flood, an analysis of the soil to find which are the plants that could grow and flourish. There's the lack of a programme, and intervention has only been in dribs and drabs: every time that the people of Africo, of Platì, of San Luca are up in arms, to calm everyone down, to get them to go home, there's news that there are 300 posts, a hundred for each town, but without regard to the need of the territory, or the type of work needed to remedy these age-old problems."

Alexander (1987) warned that the ad hoc nature of state spending on hazards in Italy makes it very prone to the sort of personal intervention on which clientalistic influence relies. Interviews carried out with the Democratic Left mayor Luigi Cesano of Irsina and with the Socialist mayor Mario Atalante of Calciano confirms this opinion. Cesano (interviewed 3.8.1992) said that his administration has to fight for funds from the regional government, but said that this struggle ensures that money for consolidation is not a clientalistic "concession" - as he claimed it is for Christian Democrat towns like Grassano. Atalante (interviewed 6.8.1992) broadly agreed with Cesano's argument but was more pessimistic on the possibility of avoiding the stain of clientalism: politics in Basilicata "is all clientalism", he claimed.

The effect of these clientalistic relationships is that patrons have a vested interest in never fully satisfying the needs of their clients for soil conservation; and in prolonging the situation whereby, rather than looking for a long-term solution, the state is waging a reactive campaign against hazards. Partly through conspiracy, partly through incompetence, the state teeters from one ill-managed crisis to the next: which ensures the continuation of the problem, and the preservation of the local political relationships based on it.

4.4 Conclusions

This chapter has set out the factors accounting for the severe intensity of landslides in Basilicata. It has examined, at a regional scale, the links between physical factors and landslides, and between social factors and landslides. It has shown that Basilicata is a region in which climatic extremes combine with a fragile ecology and geology, steep relative relief, and intense tectonic activity. But the region has been significantly changed by a long human occupation which has modified the environmental processes which occur there, particularly by the degradation of the vegetation and soil, the development of settlements, and the land improvement policies carried out over the centuries.

At the regional scale, a number of broad conclusions can be drawn. Chapter three showed that the current level of urban landslides is unprecedented, which can only be the result of human modification of the environment. This chapter has shown that the factors which give Basilicata a vulnerable physical environment, and a high "normal" level of landslides have combined with social factors to cause additional landslides.

Of the social factors, deforestation and agriculture have occurred for several thousand years and, at least at first, had no significant impact on the level of landslides. By as early as the end of the classical period they had begun to cause environmental change in Basilicata, but the rate of change increased significantly with the final destruction of the natural economy of the region by capitalism. It is also through the development of capitalism, particularly during the twentieth century, that industrial development and urban growth have come to have an increasingly important impact on the land.

The relationships examined in this chapter show physical and social factors behind the regional pattern of landslides which has already been identified. As section 2.4 indicated, these factors can only be seen as producing tendencies in landsliding across the region, and the way they have interacted can only be adequately understood in the context of a detailed case study of the contingent circumstances affecting specific landslides. Detailed research was carried out in the municipality of Grassano, which is introduced in the next chapter.

Chapter 5: Landslides at Grassano

This chapter introduces the town of Grassano and its landsliding hazard. It examines both the physical factors and the social factors that have made the town vulnerable to landsliding.

5.1 Introduction

Grassano experiences the vulnerable physical environment common to most municipalities in Basilicata. Physical factors predispose the land to landslides but, in addition, the land has been subject to considerable modification by humankind. Chapter three showed that during the twentieth century there has been an increase in the recorded frequency and intensity of landslides at Grassano, and this chapter allows an assessment of the factors behind that increase. The identification of these factors and the manner in which they have interacted allows a clear understanding of the changing pattern of landslides affecting the town, which is given in chapter six.

5.1.1 The landslides

5.1.1.1 The urban landslides

Grassano (figure 5.1) is typical of the rural settlements in the foothills of the Apennines. Its bleak glory was described by Levi (1982) as "a streak of white at the summit of a bare hill, a sort of imaginary Jerusalem in the solitude of the desert" (page 13) and characterized by "poverty and desolation... set in a monotonously sad landscape empty of softness and sensuousness" (page 155).

The town probably dates from the eleventh century and is located on a ridge of three hills, facing south, overlooking the Basento valley; its geology consists of a mixture of conglomerate, paleolandslide deposits, sandstone, and clays, with a relief rising up to 577 m above sealevel. It had a normally-resident population of 6,261 in 1981. The

Figure 5.1: Grassano

town's plan is shown in figure 5.2. It consists of a historic core to the north and west of the Via Meridionale, an area of postwar housing mainly to the south and east of the Via Meridionale, and an area of modern housing to the northeast of Via Capitano Pirrone.

The landscape around Grassano is the product of the town's economic poverty. Grassano is affected by extensive slope instability and very large urban landslides (figures 5.3 and 5.4). Almagià (1910) noted that the slope facing north to the Bilioso, tributary to the Bradano, was incized by gulleys and affected by landslides (ibid, 147). On the south side of the slope, the position was more serious:

> Typical examples of landslides... can be seen on the southern slopes of the highground of Grassano (577 m). These are formed in banks of clay overlaid by sandy strata. As can also be seen from the [geological] map (200 I) the highground is cut into by gulleys which form a bed for the muddy deposits, and which are continually cutting upslope, threatening the edge of the sandy area above. As a result of this process, the town has been damaged several times by serious landslides, for example on 10 January 1895 and in the winter of 1902. [Ibid, 157-158, translated.]

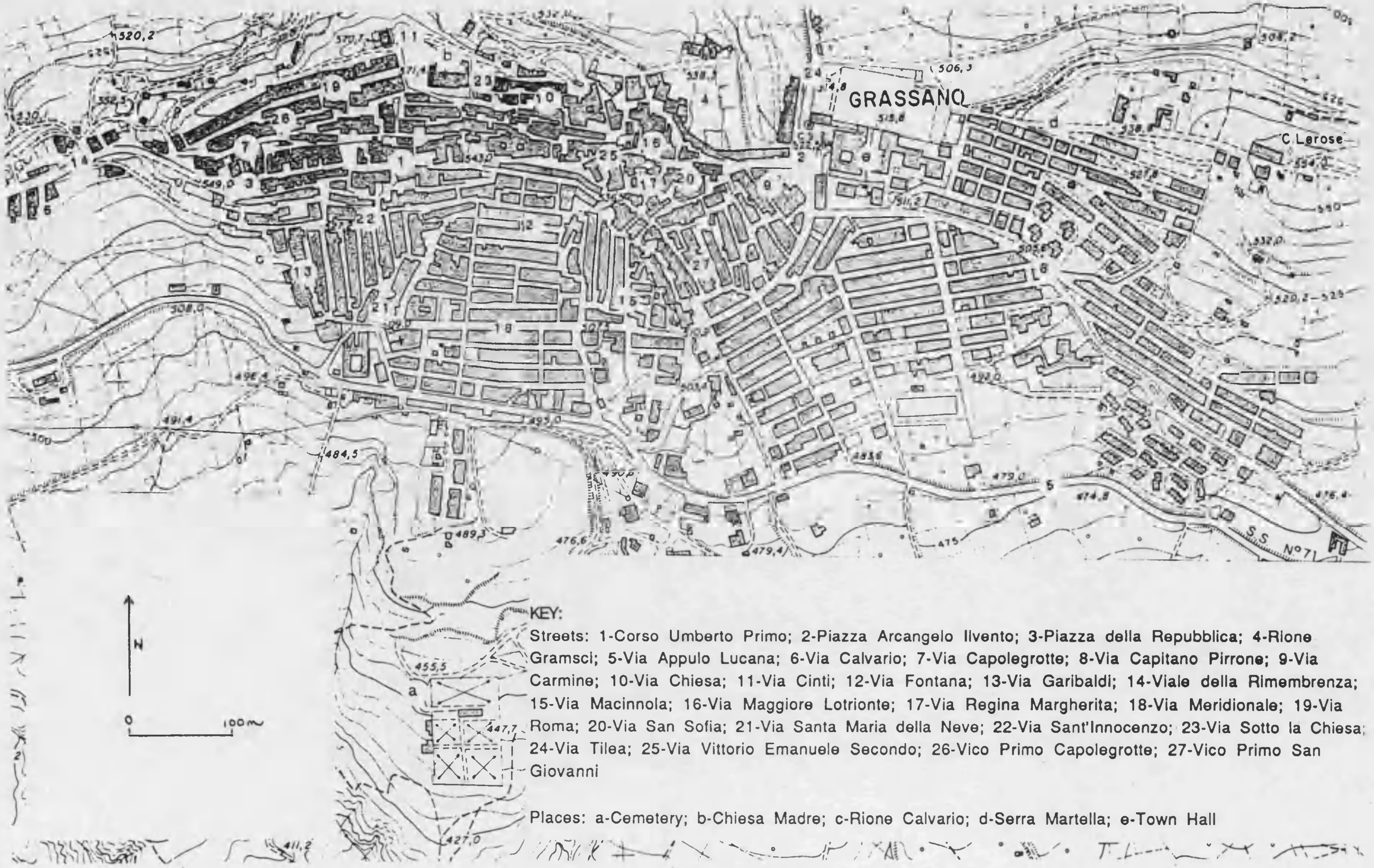
Boenzi (unpublished, 1973, 5, translated) described the landslides around the town as characterized by a general stability on the north (Bilioso) slope, but instability on the southern (Basento) slope: "on the northern slope there are visible effects of ancient movements which now seem to have reached a degree of stability; on the southern slope... the landslides are fairly active." At places, he noted, there was active calanchi erosion (particularly on the southern slope) and gulley erosion was very widespread.

The landslide hazard affecting the town in the 1980s was described by Regione Basilicata (1987, 108, translated) as follows:

> In the sandstones to the southeast of the town there are three large landslide scars. In the areas between the gulleys Fontana and Marruggio Secondo there are major landslides which affect most of the old town centre. A large rotational landslide affects the area of the Corso Umberto... On the right hand [western] edge of this land in the Calvario area there is a large rotational landslide. The left hand [eastern] edge of the landslide is also active and affects the cemetery.
>
> The new part of the town is located in an area affected in the past by a large composite landslide.

5.1.1.2 The town-centre paleoslide

The town has grown on a site underlain by paleoslides (figure 5.4) on which detailed research has already been carried out - notably Del Prete (1981), Radina and Vignola (1981), and also Cotecchia and Del Prete (1992). Conclusions on the stability of the

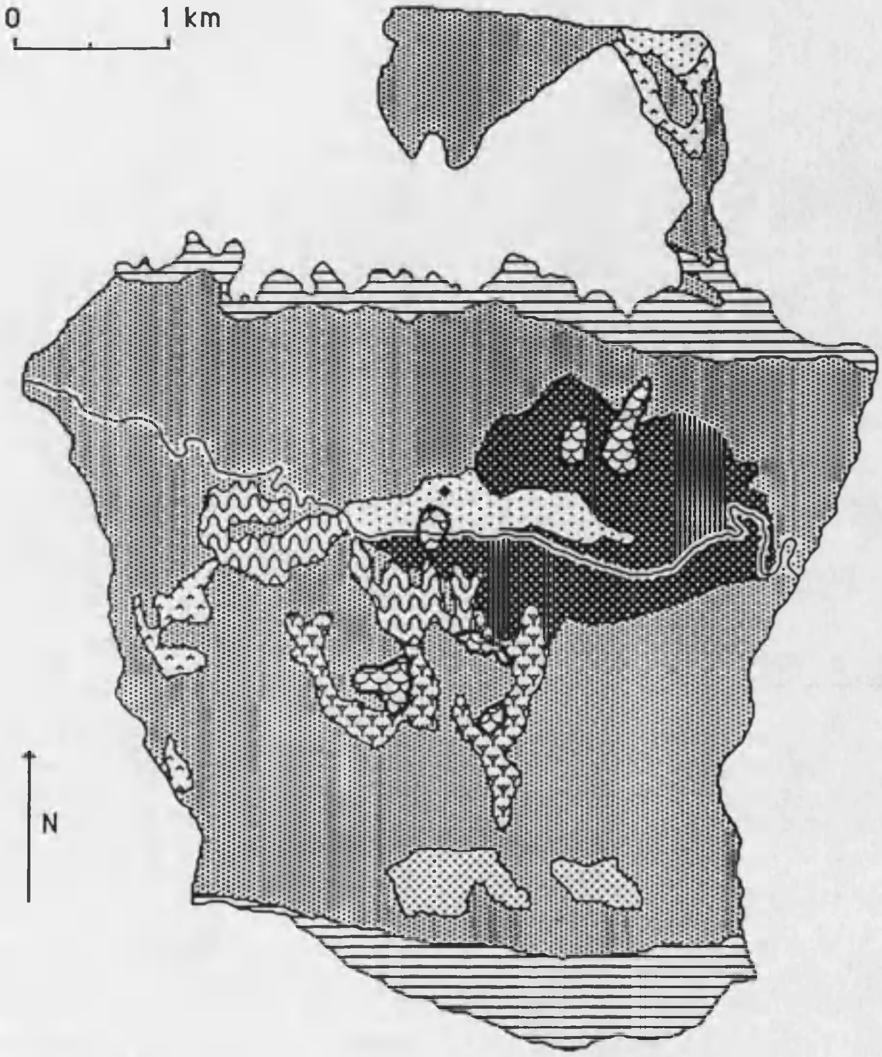


KEY:

Streets: 1-Corso Umberto Primo; 2-Piazza Arcangelo Ilvento; 3-Piazza della Repubblica; 4-Rione Gramsci; 5-Via Appulo Lucana; 6-Via Calvario; 7-Via Capolegrotte; 8-Via Capitano Pirrone; 9-Via Carmine; 10-Via Chiesa; 11-Via Cinti; 12-Via Fontana; 13-Via Garibaldi; 14-Viale della Rimembrenza; 15-Via Macinnola; 16-Via Maggiore Lotrionte; 17-Via Regina Margherita; 18-Via Meridionale; 19-Via Roma; 20-Via San Sofia; 21-Via Santa Maria della Neve; 22-Via Sant'Innocenzo; 23-Via Sotto la Chiesa; 24-Via Tilea; 25-Via Vittorio Emanuele Secondo; 26-Vico Primo Capolegrotte; 27-Vico Primo San Giovanni

Places: a-Cemetery; b-Chiesa Madre; c-Rione Calvario; d-Serra Martella; e-Town Hall

Figure 5.2: Grassano: street plan



Erosion phenomena: sheet erosion rill erosion calanchi erosion

Landslides: slump landslide

Areas at risk:

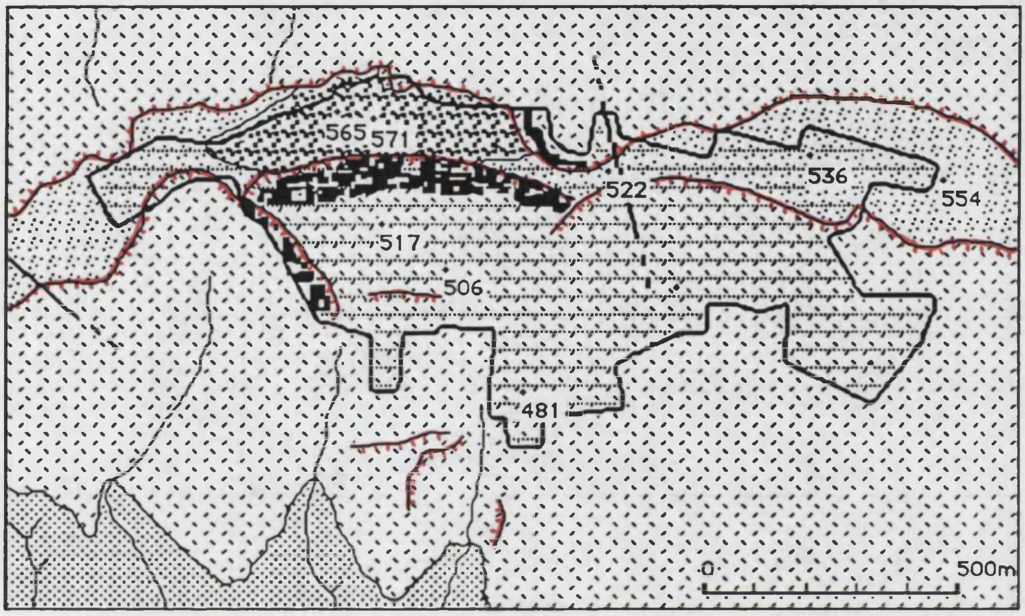
High risk: deep landslides erosion phenomena and surface landslides

Low risk: because of morphology because of outcrops

Flat valley bottoms:

◆ Chiesa Madre ╱The SS7

Figure 5.3 Grassano: slope instability (source: Il dissesto idrogeologico della Basilicata)



Subapennine clays Monte Marano sands Irsina conglomerate detritus complex
line of probable dislocation landslide scar
urban area main area of urban damage

Figure 5.4 Grassano: urban landslides (source: Radina and Vignola, 1981)

paleoslide have been contradictory in the past. This section consequently reviews the published evidence and, by combining it with a number of previously-unused sources, examines the stability of the paleoslide.

Following the definition by Varnes (1978) the paleoslide can be described as a complex rotational landslide (Del Prete, 1981; Radina and Vignola, 1981; Cotecchia and Del Prete, 1992). Past movement has created three terraces on which the town has been built. The highest terrace lies between Corso Umberto Primo and Via Appia: it slopes downwards with an inclination of around 15°. The middle terrace is occupied by the social housing south of Via Appia. And the third terrace is the area covered by the cemetery. The paleoslide has a maximum depth of about 100 m, a maximum width of about 550 m, and a length of around 950 m. The foot is at 380 m above sealevel - at the level of the Mindel terrace - and as a result Cotecchia, Del Prete, and Puglisi (unpublished, 1983) inferred that it first moved in the Mindel-Würm period, giving it an age of at least 100,000 years. They suggested that it was probably formed by a catastrophic shock or extreme rainfall event.

They calculated that the paleoslide is marginally stable. It has a factor of safety of only 1.2 so could easily be reactivated by a severe seismic shock, or even exceptional weather conditions. Destabilized by undercutting, it has probably evolved in a series of "small and repetitive" stages (ibid, 14, translated). At the foot of the gulleys Fosso Marruggio Primo and Fosso Marruggio Secondo, the eastward diversion of the slope crest indicates that the paleoslide has moved after its formation (Del Prete, 1981). It has been undercut by erosion at its foot - and movements of the slope, triggered by erosion, were noted at the beginning of the century by Almagià (1910).

Del Prete (1981) indicated that one of these movements may have been recorded after the November 1980 earthquake. Over 500 of the 3,800 homes in Grassano had to be evacuated because they were so severely damaged, and 15 homes collapsed (figure 5.4). These damaged homes were mainly grouped in the town centre, where 475 out of the 1,362 were damaged - of these 475 homes, 230 were destroyed or in need of demolition, and the remaining 245 were made unfit for use (Radina and Vignola, 1981). Eighty-five percent of the damaged homes were in three zones: east-west along the Corso Umberto Primo and parallel below it; northwest-southeast on the northern side of the town; and to the southwest of the town centre. Del Prete (1981), and Cotecchia, Del Prete, and Puglisi (unpublished, 1981) argued that this was a result of the paleoslide being reactivated by the seismic shock.

A horizontal movement of 3 mm was detected in the debris of the paleoslide between 12 January and 3 February 1981 by an inclinometer in the town centre. No movement was detected after February 3. From this it has been deduced that the total movement would have been a matter of centimetres (Del Prete, 1981). However, Radina and Vignola (1981, 167, translated) suggested that no such reactivation took place: "As far as it was possible to observe during the numerous and detailed inspections in the town centre, no evidence was observed of any mass movements whatsoever on the roads, nor signs of landslide phenomena produced at the outskirts of the town".

The damage was predominantly caused, Radina and Vignola (1981) suggested, by the depth of the paleoslide deposits. Most of the damaged homes were at the foot of the landslide scarps in the town where the debris mantle is at its thinnest, and where the transmission of seismic energy is consequently at its most efficient. The structure of the town centre makes some buildings particularly vulnerable where there is a steep drop between the upslope and downslope sides of the house. Many of the older dwellings have very poor foundations: rarely over 0.5 m deep, and sometimes none at all. Vignola (personal communication) suggested that the inclinometer readings which appeared to show a movement may have been the result of instrumental error. In their only concession to criticism, Cotecchia and Del Prete (1992, 163) denied this possibility: "...though the fact it [the movement] is so small gives rise to some doubts, it becomes entirely indicative within the whole gamut of symptoms".

Although evidence on the reactivation of the paleoslide in 1980 is inconclusive, but information from similar earthquakes in the past may allow a more confident diagnosis to be made. The first major earthquake affecting Grassano on which information is available is that of 8 September 1694, which "threw Basilicata and the provinces of Salerno and Avelino into mourning and desolation" (Martuscelli, cited by Claps, 1982, 28, translated). The earthquake had an intensity of MS VIII at Grassano (Regione Basilicata, 1987; Cotecchia and Del Prete, 1992). Little is known about its effects.

There were two contemporary reports on the earthquake, two editions of the same pamphlet. Anonymous (1694a, translated) reported: "In Grassano damage was done to the Chiesa Madre and the church of Santa Maria, with some houses cracked." Anonymous (1694b) has no information on Grassano. The limited extent of the damage described in Anonymous (1694a) is unsurprising, given the paleoslide hypothesis. At the end of the seventeenth century, the town extended over a much smaller area than it does (Camera dei Deputati, 1954; Bolettieri, 1991). Even by 1750 only a few buildings had been built on what has subsequently been identified as the paleoslide

(Camera dei Deputati, 1954). The built-up area would therefore have been less vulnerable to any possible movement of the paleoslide* .

Grassano seems to have received relatively little damage in 1694 compared to its neighbours. In Tricarico (MS VII, according to Regione Basilicata, 1987) the earthquake "Made numerous houses collapse, without injuring anyone, the rest were left damaged" (Anonymous, 1694a, translated). Accounts of events in Salandra vary (MS VII, according to Regione Basilicata, 1987). "Many houses were ruined, with the death of six people, and another who died later from fear of the earthquake." (According to Anonymous, 1694a, translated.) Or: "Many houses fell, with the death of a little girl" (Anonymous, 1694b, translated). Anonymous (1694a) also recorded that the Chiesa Madre at Calciano (MS VII, according to Regione Basilicata, 1987) was damaged.

A little more is known about the effects of the earthquake of 16 December 1857. At Grassano the earthquake had an intensity of MS VIII (Cotecchia and Del Prete, 1992). Damage at Grassano was severe: the *Giornale del Regno delle Due Sicilie* of 30 December 1857 reported "About 100 houses fallen; all the other buildings are more or less injured. A young girl of fifteen years of age was killed, and a lady had her leg broken." (Quoted and translated in Mallet, 1862, 225). The records of Grassano's main church, the Chiesa Madre, confirm there was one victim: "Philomena D'Araio, fifteen years old, daughter of Dominici and Angela Bolettieri, killed by the earthquake..." (ACMG, *Liber mortuorum parochialis ecclesia tre Grassani inceptus mense Ianuarii 1848*, Die 16 Xbris 1857, translated). An official report (ASP, Intendenza di Basilicata, 1364, 24 "Stato dei morti, feriti, e danni cagionati dal tremuoto della note de'16 Dicembre 1857") gives the same figure of one killed and one injured - and damage which was estimated at D18,000 [*approximately L500 million at 1988 prices*] by the mayor.

A letter from the mayor to the Intendente of Basilicata confirms the damage was serious. He reported on the work of builders busy "carrying out urgent repairs on

* Two main sources of inaccuracy affect the map. Only the buildings standing in 1954 were dated. Many sites have been rebuilt in the course of time, or simply abandoned, so the map can only be taken to show the approximate minimum of the town's size. There were some errors in dating of the buildings, and these problems were dealt with briefly in Bolettieri (1991). For instance, observations made for this dissertation showed the second, un-numbered, house on the left of Via Maggiore Lotrionte - going up from Via Vittorio Emanuele Secondo - is dated as "probably between 1750 and 1875". Above the door is quite plainly carved the date "1658".)

many collapsing and collapsed buildings in this municipality" (ASP, Intendenza di Basilicata, 1366, 35, letter from the sindaco to the intendente, dated 26.12.1857, translated). Especially interesting is a list of the work carried out on damaged buildings deemed to be threatening public safety. The pattern was slightly different from that described for 1980 by Del Prete (1981) and Radina and Vignola (1981), although the sample is very small and quite possibly unrepresentative. Only nineteen buildings are mentioned, their locations (figure 5.2) are given in table 5.1. Damage was concentrated along Corso Umberto Primo (one in that street, one in Via Piazza, one in Via Sotto la Chiesa, one in Via Chiesa, one in Via Sotto la Piazza). The five houses destroyed in Via Carmine, and the four in Via Macinnola, indicate intensive damage in the southeast of the town centre. And there was an evident movement in the area of the Calvario landslide of 1956 (one in Strada Pontone, two in Contrada Pontone).

Table 5.1: Grassano: earthquake-damaged buildings in 1857 (source: ASP, Intendenza di Basilicata, 1366, 35, letter from the sindaco to the intendente, dated 26.12.1857)

Urban area:	
Strada Carmine (now Via Carmine)	5
Strada Chiesa (now Via Chiesa)	1
Strada Macinnola (now Via Macinnola)	4
Strada Piazza (now Corso Umberto Primo)	1
Strada Pontone (now Viale della Rimembrenza)	1
Strada Sotto la Chiesa (now Via Sotto la Chiesa)	1
Strada Sotta la Piazza (now Via Sotto la Piazza)	1
Outside the urban areas:	
Contrada Chiesa (north of the Chiesa Madre)	2
Contrada Macinnola (near Via Macinnola)	1
Contrada Pontone (near the Piazza della Repubblica)	2

The evidence, if reliable, indicates a pattern of damage very difficult to explain by the hypothesis of Radina and Vignola (1981). Why should there have been no damage in the Via Garibaldi area? It is possible that the area became more vulnerable to seismic shock because of the landslide movements there in the twentieth century. But in that case, why should the rest of the area affected by the Calvario landslide be apparently more vulnerable to damage in 1857 than in 1980? Possibly the area around Via Garibaldi was in better repair in 1857 than in 1980 (as chapter six shows, most of the west side of the street was abandoned in the 1950s because of a landslide) although damage in 1980 was not confined to the west (abandoned) side of the street (see Del Prete, 1981). In addition, the area around Via Carmine and Via Macinnola was of about the same age and (being a poorer part of town) was probably in worse repair. Even though the buildings there are generally only of one storey there is evidence of severe damage in that part of the town.

The damage to Grassano in 1857 resembles that of 1980 in that it was a little worse than in most of the surrounding towns. At Tricarico (MS VII, according to Regione Basilicata, 1987) there were "a few injuries to buildings; no deaths" (*Giornale del Regno delle Due Sicilie*, 26.12.1857, quoted and translated in Mallet, 1862, 226). But at Salandra (MS VIII, according to Regione Basilicata, 1987) it was first reported: "A few houses destroyed, three deaths; churches and houses injured" (*Giornale del Regno delle Due Sicilie*, 26.12.1857, quoted and translated in Mallet, 1862, 222). And then: "Forty houses demolished; the rest more or less injured and falling. One body disinterred..." (*Giornale del Regno delle Due Sicilie*, 30.12.1857, quoted and translated in Mallet, 1862, 225.)

Severe damage from the earthquake of 23 July 1930 was confined to the northwest of Grassano. "Towns like Acquilonia and Melfi were almost destroyed; in others... the damage rather than being to people was to property. Infact, many houses were reduced to ruins, others severely fissured" (Claps, 1982, 78, translated). Very little documentary evidence is available on the effects of the earthquake in Grassano. The earthquake had an intensity of MS VI (Regione Basilicata, 1987; Cotecchia and Del Prete, 1992). No contemporary newspaper reports were made of damage in the town; very little attention was paid to towns away from the epicentre, and almost no council documents survive from the period.

The only existing documents concerning the effects of the earthquake at Grassano relate to the rehousing of the Pirrone family. In 1956 they sent the following statement to the prefect:

> "We are the owners of a house, made up of two rooms of which one was on the ground floor, the other was on the first floor, number 65 Corso Umberto Primo in the town of Grassano. Following the earthquake of July 1930 the house was fissured to such an extent that after about a year - to be precise 19 June 1931 - it collapsed entirely without doing any harm to us and to the family who had left as a precautionary measure.
>
> "The Genio Civile of Matera reinforced the area building a wall at the northern end making the present day Piazza Mazzini, which occupied the area of our house and the houses of others who had suffered the same misfortune.
>
> "The authorities occupied the various areas needed for the construction; promising us that as soon as the government constructed new buildings we would be among the first occupants, without being charged any rent...

"TWENTY-FIVE years have gone by and only now are the promised houses being built here at Grassano..." [AMG, Anno 1956, X, copy made by the prefetto's office of the letter from Coiugi Pirrone Innocenzo and Carchio Maria Teresa to the prefetto, dated 11.5.1956, translated.]

A number of related documents include a letter from the mayor. The cause of the problem, he explained, was "an act of expropriation by the Genio Civile around thirty years ago, to be precise when the said organization expropriated some houses in Piazza Mazzini (on Corso Umberto Primo), to erect the wall to enclose the area which was subject to landslides and dangerous." (AMG, Anno 1956, X, letter from the sindaco to the Prefettura, dated 26.9.1956, translated.)

Some corroborating evidence comes from the thirteen people who lived through the earthquake, and some of their friends, who were interviewed in 1988 as part of this research (see appendix G). Only three were able to be specific about the events of July 1930. Vittoria used to live in Vico Primo San Giovanni. She remembered an earthquake (she thought 1937 or 1938), when "Quite a lot of the houses collapsed" in her area. Particularly affected was Via Regina Margherita [nearby to the house of the Pirrone family]. She reported that on the roads running down towards Via Meridionale, the road surface collapsed, and cracks ran at right angles to the slope. Similarly, Giacomo's wife recalled an unlocated "tiny landslide", triggered by the earthquake of 1930.

Francesco remembered that there had been an earthquake but "it did very little damage". However, his wife remembered the earthquake at Rionero - though she said it was when she was "about six or seven" [this would, in fact, have made it in the 1910s]. There was damage at Grassano but it was light and mostly affected the areas of old housing near the Chiesa Madre, Rione Calvario, and the area by Via Appulo Lucano. Giacinto, a young child at the time, claimed to remember the event vividly. It has haunted him all his life, he said. The shock was in the early hours of the morning. He was taken out of his bed by his parents and carried to safety. People flocked to the cross on Via Appulo Lucano to pray for the earthquake to stop. He remembered the crying people. "That fear has stayed with me...oh! tremendous fear!... There were very many houses damaged...I can never manage to forget."

Six of the people recalled little or no damage. Beatrice: "I remember. We all went outside... Without damage, nothing." Arcangelo: "Very little happened here". Vincenzo explained "I was a boy aged four or five [in fact, he would have been six] but there wasn't much [damage]... no damage." Antonio's friend said there was "really very little" damage. Antonio (in agreement): "There's always damage, but what can I say?" Leonardo remembered an earthquake at Rionero, in 1927, '28, or '29, he said, but it was "like an echo" of the 1980 shock. Five of the thirteen (Pietro, Michele, Luisa, Santia, and Donato) remembered nothing specific at all. Pietro claimed "nothing ever happened".

Most important for understanding the landslide was Vittoria's statement. She remembered the damage and - whilst being unaware of its significance - she mentioned the transverse cracks in the road. Although Radina and Vignola were unable to find cracks in 1981, Vittoria's statement, combined with that of Giacomo's wife, and the meagre documentary evidence seems to confirm that they were there in 1930.

The evidence on the paleoslide from the earthquake of 1694 is not conclusive. Grassano had scarcely expanded onto the vulnerable areas where houses could have been damaged significantly by the seismic shock or any landslide movement. The damage done was less severe than in the neighbouring towns. For the earthquake of 1857, as in 1980, the damage to the town was as severe or more so than to its neighbours. The grouping of the (known) damaged houses is, given the smaller size of the town at that time, similar to that in 1980 - though the differences that there are imply some sort of landslide movement in addition to that from the seismic shock alone. In 1930 relatively little damage was done. The few existing documents and some of the oral testimonies suggest the damage was relatively similar to that in 1857 and 1980. The combined evidence from the earthquakes of 1857, 1930, and 1980 indicates that the paleoslide under the town centre has probably been reactivated by seismic shocks.

5.1.1.3 Other landslides

The landslides which threaten the greatest hazard to the community are the urban landslides - particularly those affecting the Calvario district of the town and the cemetery (both of which are segments of the large paleoslide - figure 5.4). With its scar beginning immediately below Viale della Rimembrenza, the Calvario landslide runs through Via Appulo Lucano, down to 335 m above sealevel. The most important recorded movements of this landslide were on 14 February 1956, 2 February 1957, and 14 January 1960 (Cotecchia, Del Prete, and Puglisi, unpublished, 1981). Movement still continues: "This is a landslide which has never become extinct and up until now has moved slowly downslope causing sinking, cracks, and steps sometimes affecting the Appia State Road [Via Appulo Lucano, the state road 7]." (Ibid, 14, translated.) On the eastern side of the paleoslide, incision of the Fosso Marruggio Secondo has eaten away and undercut the terrace on which the cemetery was built. The most dramatic movement of this landslide was on 21 November 1976 (ibid).

The eastern part of the town, the main area of post-war building, is underlaid by a rotational landslide in sandstone and detritus. The landslide is up to about 40 m thick, and is between 490 and 460 m above sealevel (Picarelli and Viggiani, 1986a). The landslide was probably caused by a seismic shock after the Riss glacial period, and has been significantly affected by erosion in the Fosso Spineto which has undercut it. There was probably some settling of the landslide after the earthquake of 23 November 1980 (Cotecchia, Del Prete, and Puglisi, unpublished, 1981).

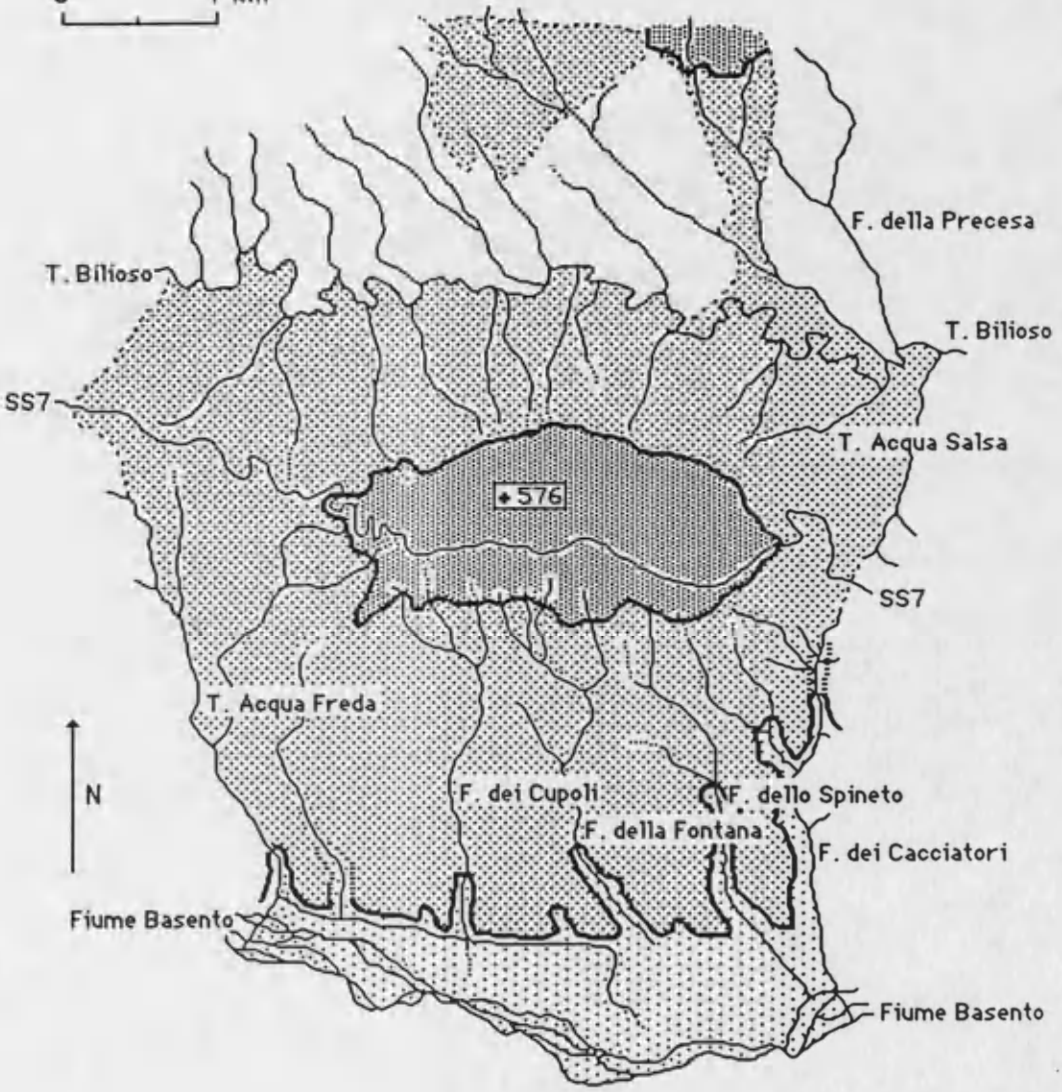
On the western edge of the paleoslide, in the Petrino district, a large landslide undercuts the national road SS7. Movement of this landslide caused a number of significant disruptions to traffic during the 1980s.

Ranged around the town are also a number of landslides which may affect the urban area in the future. Along the crest of the Serra Martella, and on its southern slope, are the remains of an ancient landslide in the process of being destroyed by erosion. On the Bilioso (north) slope of the ridge on which Grassano sits there are a large number of rotational landslides at 300 to 450 m above sealevel. They mainly affect the Mulino, Pianella, Sant'Innocenzo, and Marche districts and are probably reactivated by exceptionally heavy rainfall.

5.2 The physical factors

Grassano has a physical environment which makes it vulnerable to landslides. Steep slopes, weak and unstable geology, intense tectonism and seismic shocks, climatic extremes, and sparse and degraded vegetation, have combined in the locality to produce the preconditions for widespread and intense landsliding.

Grassano is located on the interfluve between the Basento and the Bradano rivers (figure 5.5). From the town the land slopes away steeply southwards to the Basento. There are four alluvial terraces on the slope at 397, 339, 303, and 250 m above sea level; which have been attributed to the Mindel, Riss, Riss, and Würm glacials respectively (Boenzi, Gennaro, and Pennetta, 1978). The present-day level of the Basento is 179 m above sealevel at the eastward point where it leaves the municipality.



Altitude: <200 m 200-400 m >400 m ◆ spot height
T. = "Torrente" F. = "Fosso"
permanent watercourse ephemeral watercourse
boundary not along watercourse

Figure 5.5 Grassano: drainage and relief (source: Istituto Geographico Militare)

Extremely aggressive erosion affects the slopes around Grassano. This reflects the high relative relief of the steep slope south from the town to the Basento, and the even steeper slope north to the Bilioso (tributary of the Bradano). The mean erosion rate for the Bradano valley is 1,159 tonnes per km^2 per year - which, assuming a mean rock density of 2.5 tonnes per m^3, amounts to an erosion rate of 0.46 m over the 1,000 years since the town was first developed. However, Alexander (1982) found local inter-rill erosion rates of 20 to 30 mm per year, which indicates that in places total erosion on the present site could have exceeded 20 metres over 1,000 years. The loss of topsoil and widespread gulley erosion caused by these very high rates of erosion means that almost the entire interfluve on which Grassano is located is prone to landslides (Almagià, 1910; Boenzi, unpublished, 1973; Del Prete, 1981; Cotecchia and Del Prete, 1992).

Grassano is located in the west of the Bradano Trough and shares the general geological characteristics of that zone, notably the vulnerability to landslides which typifies other towns such as Irsina, Grottole, Miglionico, Montescaglioso, Ferrandina, Pisticci, and Craco (Neboit-Guilhot, 1990). The town's underlying sedimentary deposits are sub-horizontal Plio-Pleistocene marine deposits (Boenzi, Palmentola, and Valduga, 1971), with a relatively simple solid geology: predominantly clays, overlaid by weakly-cemented sandstones, and capped by conglomerates (Del Prete, 1981) (figures 5.6 and 5.7). Details of mechanical tests on the rocks are given in appendix D.

The clays (argille subapennine) rise up to about 525 m above sealevel. They are illitic and stratified with sand - particularly so at higher altitudes, close to the sandstone. They were described as "solid to the touch, plastic, and pseudo-coherent" by Boenzi (unpublished, 1973, 10, translated).

Above the clays are sandstones (sabbie di Monte Marano) varying in thickness between 30 m to the south of the town and 70 m beneath the Serra Martella. The sandstones are in general loose or weakly cemented. They are well stratified and are interbedded with marl and gravel. The sandstones contain quartz, mica, and calcareous fines. Boenzi (ibid, 10-11, translated) described them as "coloured grey or yellow, generally with little coherence and incomplete in their diagenesis". He added that in the upper part of the series "they can however present discrete coherence, and become genuine sandstones, often exposed by differential erosion" (ibid, 11, translated).

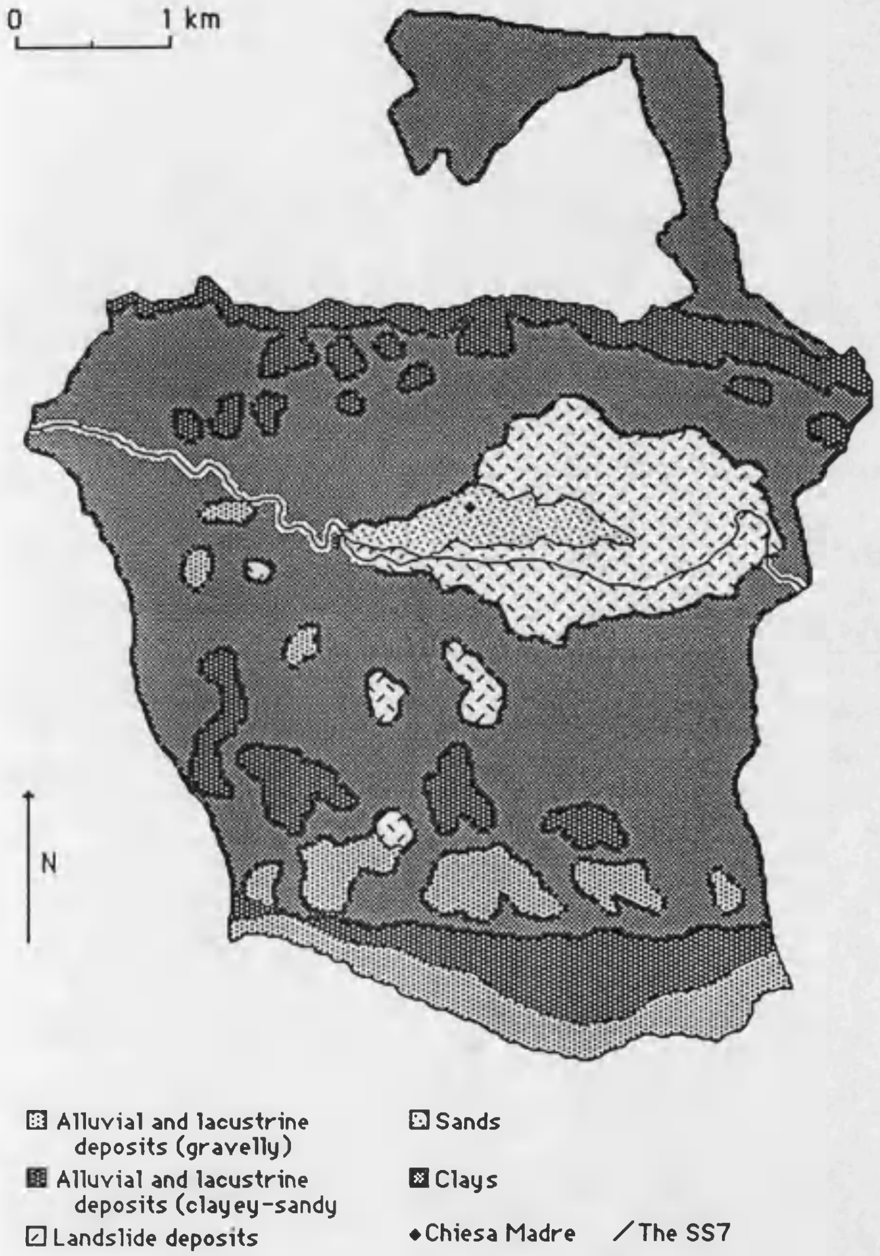
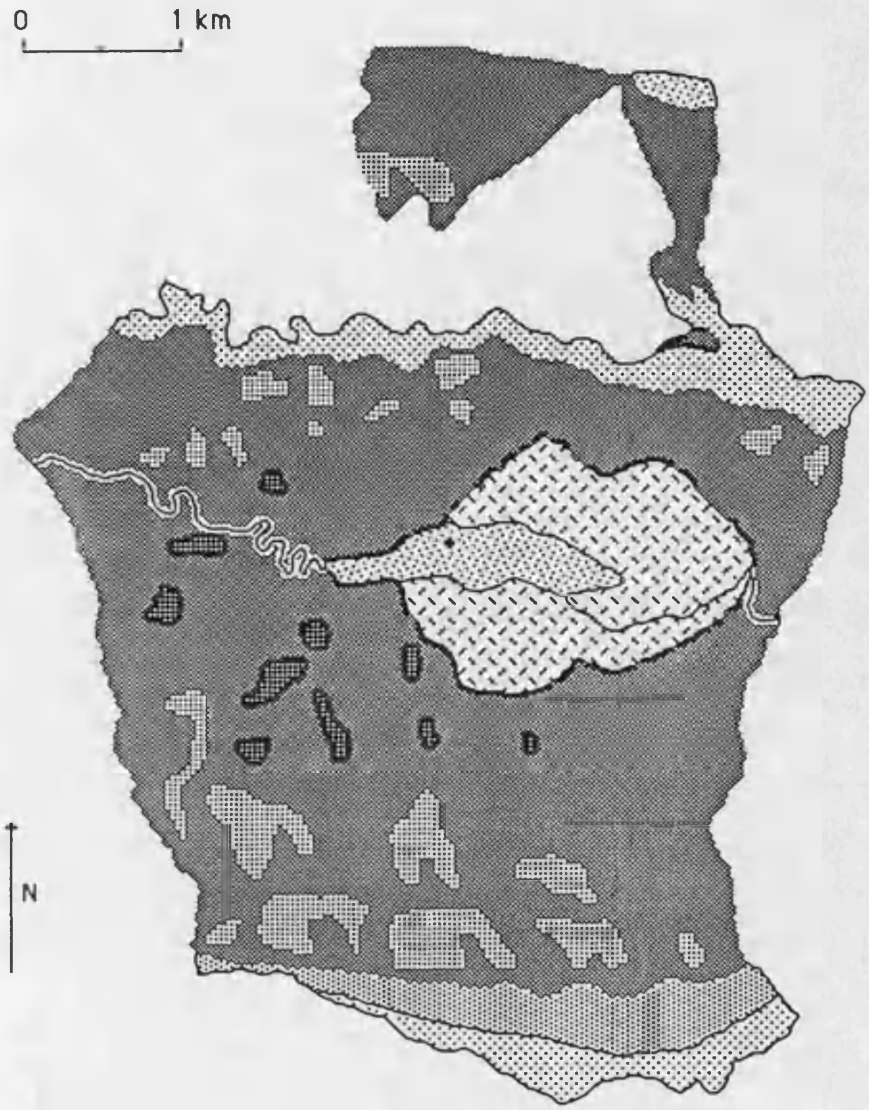


Figure 5.6 Grassano: lithology (source: Il dissesto idrogeologico della Basilicata)



Alluvial deposits: alluvial terrace deposits (generally pebbly and sandy)
pebbly alluvial terrace deposits
recent pebbly and sandy alluvial deposits
current alluvial deposits

Yellow sands

Grey-blue clays

◆ Chiesa Madre   ⁄ The SS7

**Figure 5.7 Grassano: geology
(source: Servizio Geologico d'Italia)**

Above the sandstones is a layer of conglomerates (conglomerati di Irsina) about 20 m thick. The conglomerates are polygenic in origin, laying in beds two or three metres thick. The clasts in the conglomerates are of Apennine provenence, well rounded, and held together by siliceous cement.

Spread over the slopes is a cover of detritus from the breakdown of the conglomerate and sandstones. The detritus includes sandstone fragments and is best preserved on the east of the town and on the southern (Basento) slope, particularly at around 380 m above sealevel. Del Prete (1981) concluded that the coherence of the mantle, the lithofacies, and the poor state of coherence of the fragments imply the material is ancient, formed in a warm-wet climate - probably from the Mindel-Riss interglacial.

At Grassano, earthquake shocks have been implicated several times in the reactivation of the landslide over the past several hundred years, as the previous section showed. This is because the Bradano Trough, in which the town is located, has probably been subject to uplift since the late Calabrian period (Boenzi, Palmentola, and Valduga, 1971) as a result of the neotectonism, intense earthquake activity which has affected the whole of Basilicata.

There is no fully operative climatic station for Grassano, but the figures for the neighbouring town of Tricarico (Ranieri, 1972) probably give a reasonable appproximation. Data for Tricarico shows the climate to be semi-arid** (table 5.2):

Table 5.2: Tricarico: climatic data for 1926 to 1955 (source: Ranieri, 1972)

	J	F	M	A	M	J	J	A	S	O	N	D	Total
Temperature°:	4.2	5.3	7.6	11.4	15.3	20.9	23.2	24.0	20.4	15.0	10.3	6.1	
Precipitation mm:	71	57	66	50	41	37	25	22	49	63	80	86	647

** Following Cantù (1977). The definition used De Martonne's aridity index I = 1/2 (P/T+10 + 12p/t+10): where T is mean annual temperature, P is total annual precipitation, t is temperature of the most "arid" month, p is precipitation of the most "arid" month). Tricarico has an index of 17.8: within the values of 10 to 20 which define the sub-arid; giving it "the climate of the typical Mediterranean vegetation" (ibid, 147).

There are also, for comparison, some more recent but incomplete measurements also taken at Tricarico (table 5.3):

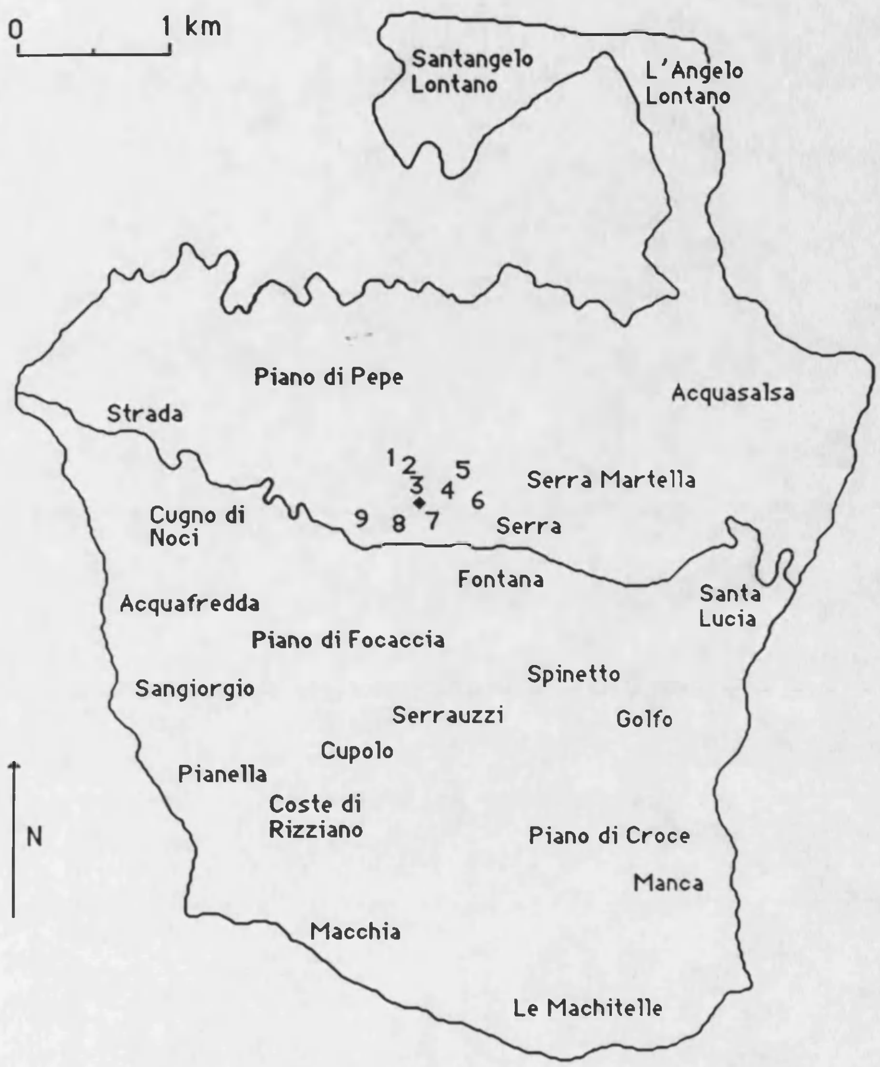
Table 5.3 Tricarico: weather details (source: *Compendio statistico della provincia di Matera 1986* (1986))

Year	*Temperature°*			*Precipitation mm*		
	max.	*min.*	*mean monthly*	*annual total*	*monthly maximum*	*frequency (days)*
1975	39.0	-	-	-	-	-
1981	35.9	-6.0	12.5	-	-	-
1982	37.5	-3.0	-	530.4	41.0	85

The climatic statistics which are available were reviewed by Rendell (1975, unpublished). Daily rainfall data is available for Grassano from 1922 to 1941 and from 1951 to 1967. This indicated a fairly rapid increase from 1922 until the mid-1930s - though the trend was probably spurious, the result of a more-assiduous reporting of low figures. From the period 1951 to 1967, total precipitation was 13,062 mm - giving an average precipitation of 768 mm per year, with a mean length of dry periods of 5.1 days (6.56 days in summer).

As Boenzi (unpublished, 1973) pointed out, the seasonal variation in the weather leads to extreme changes in slope dynamics. He estimated that at Grassano the rates of erosion in July and August are about one-twelfth of the rate in the maximum months of November, December, January, and February.

Grassano's altitude, between 179 and 576 m above sealevel for the whole municipality, implies that most of the unmanaged vegetation can best be characterized as of the "mediterraneo" type with predominantly macchia, moorland, and meadow species (see Ranieri, 1972). However, very little natural vegetation survives. Of the 3,803 ha (92.6% of the municipality) surveyed for the catasto land tax in 1988, only 131 ha (3.8% of the total surveyed) was uncultivated. There is very little woodland in Grassano: under the definitions of the 1970 agricultural census covered only 0.6% of the municipality (Istituto Centrale della Statistica, 1974), and this is mostly reforested land in the Bilioso valley, with some remnants of the old woodland on the banks of the Basento and around the Serra Martella (see figure 5.8).



◆ Chiesa Madre ∕The SS7
1 : Manche; 2 : Cinti; 3 : Sotto la Chiesa; 4 : Difesa; 5 : Le Manche
6 : Capolaserra; 7 : Carmine; 8 : Santa Maria della Neve; 9 : Calanconi

Figure 5.8 Grassano: districts (source: fieldwork)

Physical factors account for the vulnerability of the municipality to landslides, and show that even without human intervention there would be landslides at Grassano. Yet they do not explain the increase in the reported level of landslides in the twentieth century. If it is assumed that the growth of reported landslides was real, and as it has been shown that it cannot be accounted for by endogenous changes in the physical environment, it must - by implication - have been the result of human activity.

5.3 The social factors

The assessment of the social factors influencing landslides at Grassano is an important but neglected topic. According to Rendell (unpublished, 1975, 208-209): "Man tends to be blamed for the severe erosion occurring in the Basento valley, and although some idea of critical moisture conditions for runoff and shallow landsliding has been obtained, the historical background of land use and erosion within the Basento valley still requires elucidation." This section gives such a background.

Since the first occupation of the site of Grassano, the inhabitants have continued to modify the environment around them. With the breakdown of a peasant society and the introduction of an industrial society the scope and intensity of interference has accelerated. The number of people living in the town has grown, creating greater pressure on the land. The development of agricultural technology, particularly since the last world war, has allowed higher crop yields but the intensification of production by the introduction of new technology (particularly mechanization) has increased the pressures on the environment and increased soil erosion and landslides.

5.3.1 Deforestation

Historical evidence shows that Grassano was formerly heavily wooded. In the medieval period such was the density of woodland that the Duke of Salandra, the feudal lord, had a number of towers built in the woods around the municipality to spy out and signal the presence of game for hunting (Bolettieri, 1991). One of these towers survives, close to present-day Rione Gramsci.

Place-name analysis, discussed in appendix E, allows some of the former landscape of Grassano to be reconstructed. Seven of the districts (figure 5.8) were formerly at least partially wooded and have subsequently been largely or wholly deforested: Serra Martella, Capolaserra, Difesa, Serra, Cugno di Noci, Serrauzzi, Spinetto. By 1740 at least two of the districts were probably subject to degradation and landslides: Le Machitelle, and Calanconi. The British Library map "Terra di Bari et Basilicata" (K83 (30), dating from 1662) gives what seems to be a pictoral record of woodlands at Grassano which confirms these patterns (figure 5.9). Both Grassano and Tricarico were shown as surrounded by light woodland, Grottole was shown without.

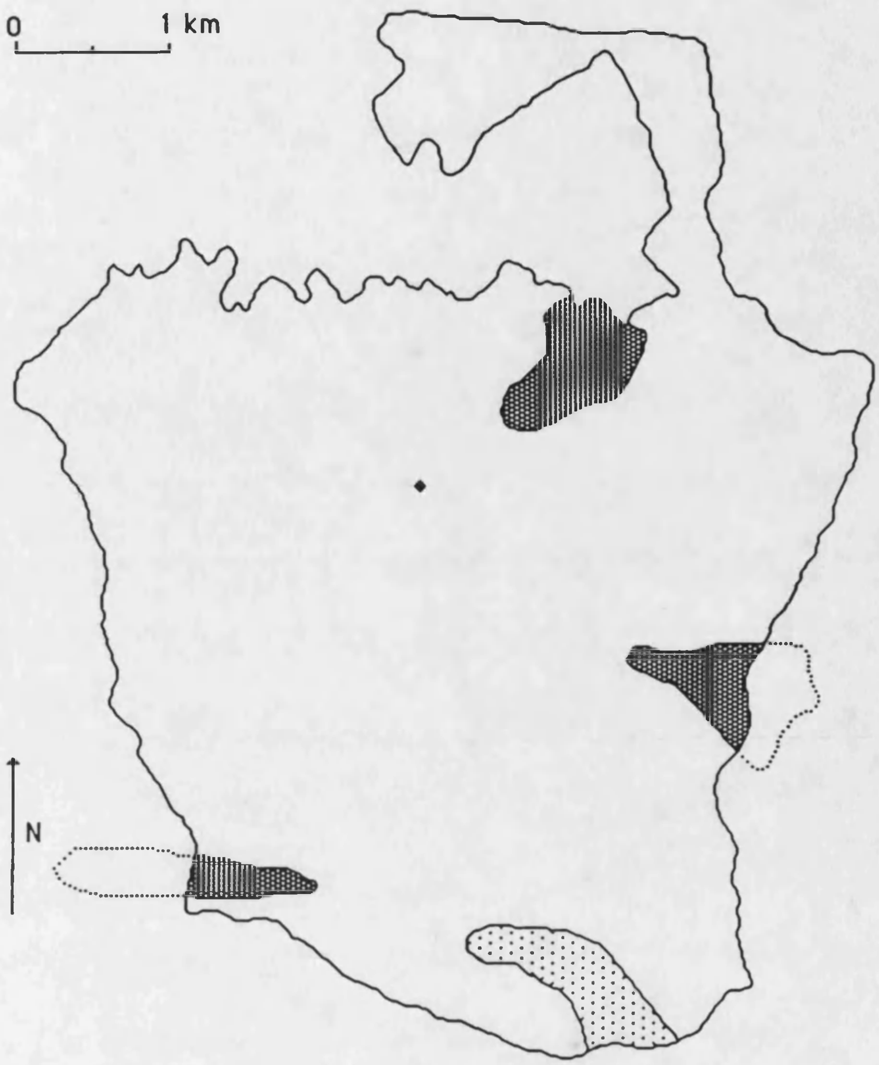
By the nineteenth century there was little woodland left around Grassano, as two documents show. A report for the French government in 1808 described a lack of woods (ASN, Ministero Interno, I, 2183, 7), and noted that wolves and foxes were consequently only migrants in the territory. In addition, the first plan of landuse for the municipality - referring to 1792 and successive dates - is that of the La Machitella district, dated 1854 (ASP, Intendenza di Basilicata, 619, 12, "Pianta della Macchitella di Grassano secondo le diverse epoche"; republished in Camera dei Deputati, 1954). It shows that squatters took hold of the area in the early nineteenth century, and cleared much of the woodland.

The earliest exact description of woodlands in the territory is a 1: 250,000 map showing the position in 1860 and 1910 - Camera dei Deputati (1910, Volume V, Section III, Part I, map "Zone con boschi esistenti in Provincia di Potenza secondo dati dell'Ispezione Forestale di Potenza"). With this map the position becomes very much clearer. The pattern is much as today with the hilltops treeless and the remnants of woodland - in the La Machitella area and bordering the Bilioso (the latter of which disappeared between 1860 and 1910) confined to the periphery of the municipality (figure 5.10).

5.3.2 Agriculture

Scott (1976) noted that for peasants the main aim in life is a reliable source of subsistence, and while the peasant society existed at Grassano there was a real fear of starvation. For example, Scottelaro (1986, 142, translated) quoted Michele Mulieri, born at Grassano in 1904, as saying "I've always worked in agriculture, which gives the most secure bread". Even in the 1950s there was still starvation: although

Figure 5.9: Grassano in 1662 (source: "Terra di Bari et Basilicata", K83 (30))



◆Chiesa Madre

Woodland cleared between 1860 and 1910

Woodland in 1910

..... Woodland extending beyond the municipal boundary

Figure 5.10 Grassano: deforestation from 1860 to 1910 (source: Camera dei Deputati, 1910)

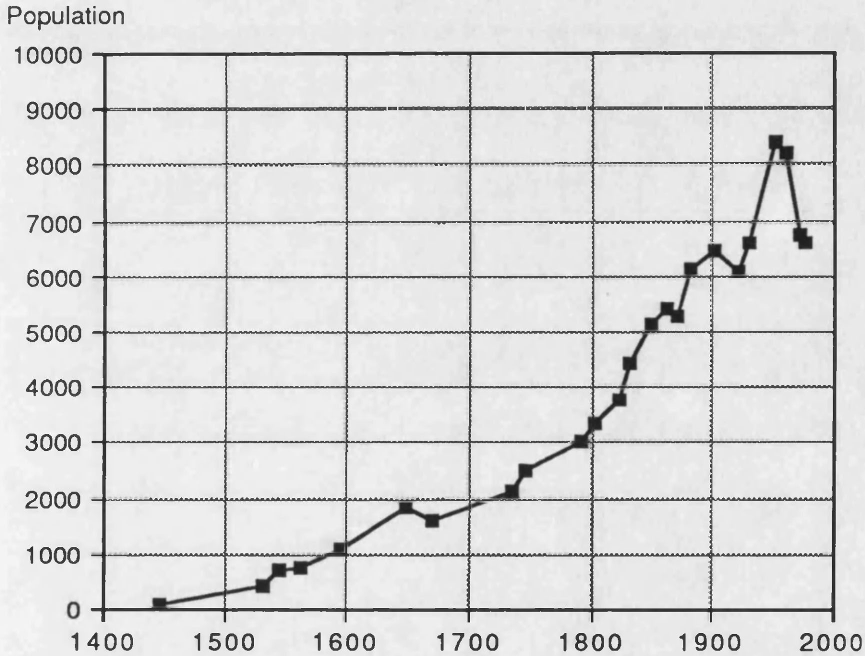
members of one-person households consumed an average of 4,014 kilocalories a day, those members of households with nine or more members consumed a mean of only 2,733 kilocalories a day. The diet had, compared to a number in Italy, low levels of animal protein and fat, and high levels of carbohydrates (Camera dei Deputati, 1954).

The town of Grassano is newer than its neighbours. A prehistoric and a Roman tomb have both been found seven kilometres northwest of the town in the Bivio Calle area, but the earliest evidence of occupation of the town comes from much later. Gattini (1910) reported that in 1280, mention was made of "Tricarico cum Craciano" - which was previously thought to be the earliest documented reference to Grassano (Camera dei Deputati, 1954). But evidence found in the writings of Allesandro di Meo indicates that settlement had begun around Grassano's castle by around the eleventh century - and founded even earlier. Allesandro di Meo (1795-1819) recorded that in 1060 mention was made of "Castellum, quod vocatur Crassanum" as being part of the territory of the Bishop of Tricarico (III, 18). In 1070, the parish of Tricarico included "Castel Grassano" (III, 98). And in 1123 the Pope confirmed "Crassano" to the Bishop of Tricarico (IX, 292).

Grassano grew slowly. By 1447 it had 16 hearths, indicating probably between 64 and 96 inhabitants (Sebastiani and Sebastiani, 1979). Early settlers probably came to the town after the abandonment of Irso in the mid-twelfth century, and after the destruction of Altojanni - the date of which is unknown (Camera dei Deputati, 1954; Sebastiani and Sebastiani, 1979). Growth continued slowly until the nineteenth century (figure 5.11).

The peasant society had begun its slow transition to industrialism by the end of the nineteenth century. Fundamental in this process was the demographic transition from the 1870s (see Camera dei Deputati, 1954). Average life expectancy at birth rose from 25.5 years in 1810-1811 to 42.9 years in the years 1950 to 1951. Particularly important in the fall of the death rate was the rapid decline of endemic diseases which followed the infrastructural improvements of the Fascist period. Diarrhoea and entiritis accounted for 19.2% of deaths in the period 1921 to 1927, and 6.3% in 1948 to 1952; malaria accounted for 0.7% of deaths in the period 1920 to 1927, and none after the 1940s. The population of Grassano was 5,426 in 1861; it reached a peak in the 1950s; falling to 6,261 in 1981 (Sebastiani and Sebastiani, 1979; Istituto Centrale della Statistica, 1984b).

Figure 5.11 Grassano: population



Poverty and opportunities abroad encouraged significant emigration from the 1860s, which accelerated after 1875. From 1901 to 1929 there were 3,026 emigrants (2,554 of whom had been dependent for a living on agriculture): 59% went to the United States, 28% to Argentina (Camera dei Deputati, 1954). The closure of emigration in the 1920s led to still greater pressure on household resources, and an increased poverty - although migration to elsewhere in Italy became a partial substitute for migration abroad. Between 1934 and 1953, 1,399 people left Grassano for other municipalities, and 902 arrived. The last world war, with its opportunities for higher earnings, led to a temporary improvement of economic conditions for some - but after it, migration continued. With the exception of 1973 there was a negative migration balance for every year from 1961 to 1985 (Rota and Latronico, unpublished, 1986). remittances from abroad have always proved helpful to Grassano, and a surely-conservative estimate put the figure at L373,691 in 1971 (Il Politecnico, unpublished, 1972-1973).

The poverty of the town is a legacy of its marginal agricultural status in the past - a status shared by many settlements in Southern Italy (Blok, 1969; King and Strachan, 1978). From the foundation of Grassano, until around 1500, the local economy was mainly based on pastoralism. Although the relatively low intensity of early agriculture at Grassano would have prevented widespread environmental disruption, it is likely to have caused substantial deforestation. Intensive cultivation of vegetables and vines was carried out close to the medieval town. Some local names, as an interview with Leonardo Pontillo showed, retain records of former intensive landuse: of particular interest being U Chian Fafal ("bean plain") downhill of present-day Piazza della Repubblica; and A Vegn u Duc ("the Duke [of Salandra]'s vineyard") near present-day Rione Gramsci. The steep slopes close to the town, like those of the Calvario and Fontana districts, were particularly vulnerable to environmentally-insensitive production and have been substantially eroded (Almagià, 1910; Regione Basilicata, 1987).

From 1500 there were substantial social changes in Grassano. Gentry and peasants arrived from Tricarico, Garaguso, and Ferrandina (and particularly after the destruction of Oggiano by landsliding in the seventeenth century). The number of hearths in the town rose to 310 in 1648 (a population of 1,240 to 1,860) and to 637 hearths in 1745 (a population of 2,548 to 3,882). The first time the population was measured directly was in 1745, when it stood at 2,503 (Sebastiani and Sebastiani, 1979).

From the beginning of the seventeenth century at Grassano the accumulation of small amounts of land by a number of agricultural workers enabled them to begin a consolidation of property and the development of small, market-oriented farms (Camera dei Deputati, 1954). In the period 1600 to 1745 the new agriculture became progressively more important than pastoralism to the local economy as the diffusion of grapes, olives, and fruits helped stimulate a more profitable and more intensive cultivation of the land.

The slow accumulation of wealth by farmers, traders, and artizans allowed the development of a new middle class. By 1745, 94 farmowners controlled 20% of the local income (Ambrico, 1964; Giura Longo, 1967) and Grassano was linked increasingly closely to the national economy. Gaudioso (in Pedio, 1965, 72, translated) described the importance of these new, larger farms to the local economy. By the late eighteenth century, the people of the town were "Living with the labours of sowing and working on the larger farms."

Accumulation was helped by a tax regime that was not quite as harsh as in the surrounding towns. The *Relazione Gaudioso* of 1736 (Pedio, 1965) showed that the province of Matera paid a disproportionately high 13.1% of the total direct tributes to the crown of the Kingdom of Naples while the province had only 10.3% of the population of the Kingdom - excluding the capital, Naples (data from Pepe, 1965). Grassano had a marginally easier burden of taxes to its feudal authorities - having 1.35% of the province's hearths (households) but paying 1.01% of its total feudal dues (data from Pedio, 1965; and Pepe, 1965).

There are few descriptions of the land at the time. For example, Antonini (1797, first published in 1745) passed over Grassano but wrote of Tricarico that "it continues to be one of the best areas in the region, and contributing to this in no small way are the soils - excellent for grain, and for meadows - and the woods, in which there is a great deal of game, serve to fatten up large numbers of pigs." (1797, 56-57, translated.) However, there was some evidence of environmental problems. He described the countryside of Grottole, which borders on the east of Grassano, as: "similar to its neighbours... though rather more degraded, but... excellent for meadows and grain." (Ibid, 56, translated.)

Capitalist agriculture became progressively more important in the local economy as accumulation progressed. By the nineteenth century the rates of return on the land became high enough to allow some of the more affluent peasant farmers to obtain mules and donkeys. As the land became more intensively used around the town, farming spread outwards to land which had previously been uncultivated - by the nineteenth century, for example, areas of land around the feudal reserve of La Machitella had already begun to be squatted (ASP, Intendenza di Basilicata, 619, 12 "Pianta della Machitella di Grassano secondo le diverse epoche"; reproduced in Camera dei Deputati, 1954). Grassano became noted for its cash crops: Giustiniani described the municipality (1802, 106-107, translated) as "situated in a mountainous area, and in the territory wheat, wine, oil, and cotton are produced. There are about 3,000 inhabitants, for the most part engaged in agriculture and in trading their surpluses in and outside the province [Basilicata]."

The Catasto land tax allows a partial reconstruction to be made of the way that land was used in Grassano at the beginning of the nineteenth century (ASM, Vecchio Catasto dei Terreni della Provincia di Matera, 91, 1). It shows that the most intense production was concentrated around the edge of the town - though this was where the slopes were steepest. The districts around the town had most, if not all, of their land under viticulture. Serra Martella had 12.8 ha surveyed, all of which was under viticulture. Similarly, all of the 8.8 ha of Calanconi was under viticulture. Grain production was concentrated in the outlying districts, particularly on the relatively flat terrace plains of the Basento valley. Most of these districts contained farmhouses, which allowed their occupants extended stays away from the town. All of the 203.8 ha of Pianella were under grain (the district included farm buildings belonging to two families); Cugno di Noce had 109.3 ha of which 95.1% was under grain and 5.0% was under viticulture; while at Coste di Rizziano 99.2% of the 136.0 ha was under grain and 0.9% under horticulture (the district included four farmhouses).

The abolition of feudalism and the subsequent concentration of landownership had the result of encouraging the growth of a rural bourgeoisie responding to and exploiting the needs of the market (see Izzo, 1976). Some redistribution of land also took place at Grassano, with the remains of the feudal reserve of La Machitella which had not been squatted becoming municipal property. Some land in Grassano was also sold off by the former landowners, often at very low prices (Camera dei Deputati, 1954). Most importantly, farmers from Grassano were able to obtain new land in the surrounding municipalities.

The population continued to grow during the nineteenth century, and a number of strategies were adopted to feed it. There was a slow extension of the area of cultivated land (table 5.4) - particularly the area under grain (table 5.5), and a subdivision of plots which continued up until the last world war. The expansion of grain production, particularly in marginal areas, has significantly increased environmental degradation, as Bolettieri (1991, 24, translated) indicated: "to have land to give over to grain, an indiscriminate deforestation was carried out, leading to continuous landslips after rain."

The number of poor peasants increased during the latter half of the nineteenth century and although there was a decline in the death rate, the latter years of the century saw widespread destitution in the town and increasing emigration. The land was increasingly subdivided to accommodate the growing population. In 1814 the average landholding had been 2.98 ha, but by 1942 it had shrunk to 1.28 ha (Camera dei Deputati, 1954). In response to the growth of poverty two mutual societies were set up to provide some protection from want.

The impoverishment of the peasantry continued into the twentieth century. Levi (1982, 159) described the situation in the 1930s as follows: "The peasants of Grassano lived off advance payments for the crops, but when the harvest came around they were rarely able to pay back what they had borrowed. Every year their obligations grew and they were more and more entangled in a web of squalor and debt."

Although the available statistical data is not comprehensive, some general conclusions can be made about agricultural changes at Grassano. The deforestation and land degradation that characterized the nineteenth century were accelerated by the Battle for Grain in the 1920s and 1930s, which raised prices and encouraged a more intensive use of more land (tables 5.4 and 5.5). Mussolini himself visited Grassano in 1936 and, in a promotion for the programme, helped thresh grain in the Cacciatori district (Bolettieri, 1991).

Table 5.4 Grassano: proportion of land cultivated from 1929 to 1970 (source: Il Politecnico, unpublished, 1973)

1929	92.4%
1942	93.3%
1953	93.8%
1970	88.3%

By the middle of the twentieth century the uncultivated area of the municipality, wasteland or woodland, had shrunk considerably. Most of the land was taken up by grain, but there had been a significant growth in horticulture and a decline in pasture (table 5.5). The third agricultural census (Istituto Centrale della Statistica, 1985) was measured on a different statistical basis - the 5,458.18 ha occupied by residents of Grassano - of which 70.9% was under grain, 10.9% permanent pasture and meadow, 7.9% permanent cultivation, 15.6% woodland, and 8.7% other landuses.

Table 5.5: Grassano: landuse from 1814 to 1942 (source: Camera dei Deputati, 1954)

Year	*Grain*	*horticulture*	*olives*	*pasture*	*vines*
1814	68.7	0.5	1.3	19.5	9.1
1942	68.1	2.9	1.3	18.5	9.1

The changes in landuse since the last world war reflect the changing requirements of a modernizing society. Most significant was the decline in importance of agriculture and agricultural employment. In 1951, 81.9% of the working population was employed in agriculture, in 1981 the figure had fallen to 22.7%. At the same time the proportion employed in industry rose from 10.0% to 40.8%, in commerce from 4.5% to 14.4%, and in other activities from 3.5% to 22.1% (Rota and Latronico, unpublished, 1986).

5.3.3 Construction

The town has expanded rapidly during the twentieth century to accommodate a growing population, higher standards of personal space, and smaller households. This has had a significant environmental impact. Housing had begun to spread to the east and south of the old town from the 1930s. This expansion has been officially encouraged since the first urban plan, the *piano regolatore generale* (PRG) and its later modifications. Building has caused many problems. The construction of engineering works (including those for consolidation against landslides) has often been penny-pinching. The problem is made worse still by the original poor construction of many engineering and building works (the evidently variable quality of which has been - it is claimed - the result of corrupt building practices and lax inspection).

Some indication of the sort of problems that can arise through shoddy construction can be given from an incident recorded in 1942 when 16 metres of a retaining wall between Viale della Rimembrenza and Via Roma collapsed. A report noted: "The collapse happened because of stormwater pouring from the said rampart and infiltrating the shoulders of the wall, which lack supports and with a void behind it; contributory causes are the age of the wall, its insufficient thickness compared to its height, and the lack of its foundations." (ASM, Genio Civile, I, 482, folder: *Lavori di ricostruzione della parte crolata del muro al ramparte di via Roma nell abitato di Grassano*, "Perizia dei lavori di costruzione della parte crollata del muro di sostegno al ramparte di via ROMA nel Rione Calvario dell'abitato di Grassano", translated.) Similarly, a report in 1947 described a large number of the roads as resting on banks "barely cemented and made of sands which are almost completely lacking in cohesion" (ASM, Genio Civile, I, 482, folder: *Grassano: consolidamento rione Purgatorio ecc*, "Perizia dei lavori di consolidamento del rione Purgatorio della via S. Lucia, del largo Puntone e del fosso Fontana dello abitato di Grassano", translated).

Housebuilding has added to the problem. According to the 1981 census (Istituto Centrale della Statistica, 1984b) there were 1,825 homes in Grassano, of which 21.8% were built before 1919, 8.6% between 1919 and 1945, 21.4% between 1946 and 1960, 20.7% between 1961 and 1971, 9.4% between 1972 and 1975, 17.5% between 1976 and 1980, and 0.5% in 1980 and 1981. In 1988 the built-up area of the town occupied 16.57 ha (UEM).The rapid postwar increase in construction has led to many problems: in 1964, for instance, the mayor wrote to the Genio Civile to alert them to a threat from landslides uphill of Via Capitano Pirrone "in some areas building has led to heaps of debris over seven metres high. A lot of percolating water is noticeable and could threaten the stability of the new buildings and provoke the slipping of all the soil above." (ASM, Provveditorato alle Opere Pubbliche, I, 177, letter from the sindaco to the Genio Civile, dated 15.4.1964, translated.)

Building, particularly the tarmacking of roads, tends to reduce infiltration and increase runoff (I Douglas, 1983). The modern increase in water consumption, drainage, and sewage have also acted to contribute to the increase in landsliding. Piped water arrived in the town in the 1920s (Bolettieri, 1991) and a reservoir was built near the Chiesa Madre: though for many households it has only been available since the 1950s (see Camera dei Deputati, 1954). With higher standards of living, water consumption has increased dramatically. This increase seems to have been directly linked to landslides caused by gulley excavation, promoted by sewage runoff.

Since the 1970s, the reservoir's 400 m^3 capacity has regularly been exhausted each day. The water, most of which will drain from the town, represents a significant increase in runoff. Grassano's precipitation of about 768 mm a year on the town's 16.57 ha will amount to 127,000 m^3 over the year: assuming full daily consumption of the reservoir, reservoir water will increase runoff by up to 146,000 m^3 a year - that is by a very substantial 115%. The town's drainage, which includes some street drainage, originally ran into the Fosso dei Lupi, downslope of the Calvario landslide. After the Calvario landslide of 1956, fear that the drainage would reactivate the landslide led to the water being redirected to the Fosso Fontana, by the cemetery. After the cemetery landslide of 1976 fears that the drainage would reactivate the landslide there led to the water being canalized (interview with Giuseppe Vignola, 23.5.1991).

Drainage was generally slow from the unpaved and unguttered streets which were ubiquitous until the 1950s. The project to provide the first guttering for Corso Umberto Primo (then the main road of the town) was not begun until 1951, at which time it was noted that infiltration along the road was causing damage to surrounding buildings (ASM, Genio Civile, I, 14, file: *Progetto dei lavori di consolidamento dei Rioni Meridionale S Innocenzo, Piazza e Purgatorio dello abitato di Grassano,* "Relazione"). Likewise in 1962 it was proposed to pave the Corso Umberto Primo and Via Regina Margherita because they were allowing "infiltration of rainwater with serious danger for the stability of the adjacent buildings". (ASM, Provveditorato alle Opere Pubbliche, I, 177, letter from the sindaco to the Genio Civile, dated 4.6.1962, translated.)

Flooding is frequent at Grassano. In 1986 EAAP, the Ente Autonomo per l'Acquedotto Pugliese, produced proposals to spend L2 billion [*L2.2 billion*] to improve the water supply and drainage of the town. EAAP found the problems were the age of pipes (many of which had rusted), inadequate flowcapaities, and frequent rupture because of heavy traffic and geological problems (UTMG, file: *Rete Idrica Abitato (Progetto per il Risanamento della Rete Idrica e Fognante nell'Abitato di Grassano),* "Relazione"). According to a note attached to the folder, a total of thirty roads were susceptible to flooding by sewage (ibid, "Strade fognante sogette ad attuazione").

The localized increase in soilwater caused by faulty drainage and leakage has led to an increase in the likelihood of landslides. In at least one case it has actually caused a small landslide: in Piazza San Domenico on Via Meridionale. After heavy rains affecting Grassano in October 1957, burst drains under Piazza San Domenico caused a landslide and significant damage to the road under the square (*Basilicata,* 1957).

5.3.4 Land management

Landslides in Grassano have worsened during the twentieth century. The various measures taken to counteract landslides in the municipality are described in detail in appendix C. Although there have been a number of projects to reclaim land throughout the municipality, there was little money to combat urban landslides until the 1970s. A lack of knowledge about the scale of the problem did little to encourage spending, and the lack of money available to be spent acted to stifle requests for more aid. It was only with the cemetery landslide of 1976, and later with the 1980 earthquake which affected much of Southern Italy, that significant funding allowed management of the newly-recognized problem - but the only approach feasible was grounded in the political and social realities of Grassano, rather than the requirements of the land. This increase seems to have had only limited success in assuaging fears about landslides - a phenomenon which will be discussed in chapter seven.

5.4 Conclusions

This chapter has examined the complex nature of the physical and social factors that have interacted to produce the specific local pattern of landslides at Grassano. The town has been taken as an example of those towns described in chapter three where urban landsliding has increased during the twentieth century. It has shown that Grassano has an environment very susceptible to landslides (indeed, the town-centre paleoslide predates the occupation of the site by at least 100,000 years); but it has also shown that society has changed the landslides at Grassano by interfering in a vulnerable environment. The changes in the landuse around the town imply that this increase began before the twentieth century, but the major changes in the use of the land have been during the rapid social and economic change of the present century - notably the intensification of agriculture around the town, and particularly the major increases in housing, and the introduction of drainage and sewerage. These changes have made a significant contribution to the increase in the intensity of the landslides.

By discussing the specific nature of the factors accounting for landslides at Grassano (the combination of a vulnerable physical environment and an increasingly intense use of the land) this chapter has confirmed that Grassano typifies many of the regional trends discussed in chapter four. The example of Grassano implies that at least some of the increased reporting of landslides discussed in chapter three was because of a real increase in landsliding. But it does not show conclusively that this was the case, and such evidence can only be provided by the detailed history of landslides at Grassano in chapter six - which is put in context by the analysis of the social perception of landslides given in chapter seven.

Chapter 6: The history of landslides at Grassano

This chapter outlines the history of the landslides affecting Grassano, in order to provide detailed information for an assessment of whether there has been a real increase in the intensity of landsliding in Basilicata over the past two centuries.

6.1 Introduction

Research has already been carried out to provide histories of the landslides reported at some of the towns in Basilicata (Guericchio and Melidoro, 1974; Del Prete and Petley, 1982): it has provided evidence showing a reported increase of landslides similar to the regional pattern described in chapter three. But this dissertation is the first research to use detailed case-study material to show the relationship between regional factors of structuration and contingent local factors - from which it is possible to determine whether the increase in landslides has been a real one or only an apparent one.

6.2 Environmental change before the twentieth century

As chapters two and three showed, the general fertility of the land throughout Southern Italy has shown a decline over the past two thousand years. Grassano has a typically vulnerable environment, and as chapter five showed it has experienced pressures on that environment which are similar to those which have affected the whole of Basilicata discussed in chapter four.

Grassano proved no exception to the regional trend: what was once fertile is now sterile. The origin of its name gives some evidence on the environmental changes that the area has experienced. It probably came from the dialect term "grassili" (meaning a fertile place, according to Camera dei Deputati, 1954) vulgarized into Latin as "Grassus", "Crassia" or "Grascia". The arms of the town depict two golden horns of plenty, filled with grapes, displayed above the three green hills on which the town developed which "attests to the fertility of the town" (Gattini, 1910, 30, translated).

Although Basilicata had been subjected to severe degradation since the sixteenth century, the historical sources examined for this dissertation described Grassano and the neighbouring municipalities as very fertile. Early evidence relating specifically to Grassano is difficult to find, principally because it only became an independent municipality in 1648 (previously it had been a district of Tricarico). Many historical sources consequently ignored Grassano, but inferences on the state of its land can be gained from descriptions of its neighbours.

According to Edirsi, writing in the twelfth century, Tricarico was "surrounded with woodlands, pastures, and fields" (translated into Italian and paraphrased by Pardi, 1919, 127, translated), and this favourable description was characteristic of the municipalities around Grassano. Irsina was described as a "'beautiful town' with 'land rich in vines and trees, and very productive'" (translated into Italian and quoted by Pardi, ibid, translated). And Grottole was "in the middle of land that produces every type of grain, and rich in pasturage" (translated into Italian and cited by Pardi, ibid, translated).

Mazzella (1601) made only passing references to Grassano, but like Edirsi, his descriptions claimed the land to be fertile and healthy. Similarly, Pachichelli (1702, 276-278, translated) described Tricarico as being "flat and spacious and with abundant wine and wheat, in the foothills of the Apennines, and in very healthy air". Ferdinando (1721, 145, translated) gave a similar description of Tricarico:

> The town is in the foothills of the Apennines, between the two rivers Obliviosum [Bilioso] and Vasensum [Basento]... The air rejoices in being mild and healthy. On one side are most fertile mountains, close to the town; on the other are beautiful fields spread out over a broad plain. The surroundings are as much mountainous as flat, and irrigated by many streams. The soil gives the best produce and most highly praised wine, the luxuries of life as well as its necessities grow in abundance.

The first full description of the environment of Grassano was given in the platea inventory of 1763: "The air is healthy; the territory is fertile in every way and gives delicious abundance of precious grains, and generous wines..." (ASM, *Cabreum, platea seu inventarium omnium buonorum venerandae commendae Grassani factum... in anno 1763 et 1764*, 12r, translated).

The evidence on drainage problems and the state of the land demonstrate that in Grassano, too, there were problems of land degradation. There is some evidence to suggest that watercourses in and around Grassano seem to have been torrential and seasonal for at least several centuries - a characteristic diagnostic of degraded water basins which have experienced severe soil erosion (Tricart and Cailleux, 1972). Alberti (1550, 201, translated) wrote of the Basento that: "Like all the others in this region, this river becomes very full in rainy periods, and in the winter from the water coming down from the mountainside. Sometimes the force of the water is such that the wooden bridges the local people build are carried away in the flood..."

Confirmation of degradation comes from a manuscript written at the end of that century, the *Inventario seu descrizione... de Ferrante Corsuto nell'anno 1585* (AAT) which described the boundaries of Grassano, which followed a number of dry valleys and a gulley - indicating significant land degradation. From the starting point of Pietra Colletta the boundary went south to Acquafredda following a gulley. From Acquafredda it followed a series of dry valleys then from the Basento up to La Scaricata, from La Scaricata to the Bilioso, and along the "dry valley at the foot of the Isca di Ripa" (ibid, 16r, translated).

Although the early inhabitants of Grassano left few written documents, a fragment of their experiences survives in the name of the Bilioso torrent. Since at least the end of Byzantine dominance, the Bilioso has been renowned for its torrential, fluctuating discharge. The name, Racioppi (1876) suggested, comes from the Greek "Ουλιος" , "pernicious". This aspect of the Bilioso's behaviour was noted again in 1839 when the Engineer of Water and Roads pointed out that the torrent formed a formidable obstacle to road-building. In flood, he noted, the Bilioso could rise up to 5.3 m (ASP, Intendenza di Basilicata (1806-1860), 50, 151 letter from L'Ingeniere di Acqua e Strade to the intendente, dated 11.6.1839). The poor drainage of the watercourse was noted by Levi in the 1930s (1982, 145), who described the Bilioso as a "malaria-ridden stream".

There is evidence that landslides have affected Grassano for several centuries. The Calanconi district of the town is known by a number of local names, including Pontone/Puntone - in dialect "U Pndon". The name means "the point" and implies that the present-day arrowhead shape to the land at Piazza della Repubblica (caused by the subsidence of the Calvario landslide) has been a longstanding feature. The name Calanconi (dialect: "U Calncon") is restricted to the Bradano/Basento interfluve (Giacomo Lagamma, personal communication), although there is the tantalizing possibility that the name referred also to the Pontone area but this cannot be substantiated. No major landslides are recorded near the town in the Calanconi district (Cotecchia, Del Prete, Puglisi, unpublished, 1981).

The general state of the land was described in a letter sent in 1812 on behalf of the decusionati (councillors) of Grassano to the Commissario del Rè which gave the earliest explicit reference to landslides in the municipality. Aiming to expose the problem of environmental decay they claimed:

> [The municipality] has a territory which is very restricted, sterile, and unrelated to the number of inhabitants...
>
> The small reserve called La Machitella which is the only heritage of the municipality of Grassano is a piece of land of about two hundred and sixty tomoli [87.5 ha], kept closed throughout the year, which is let for growing grain, or meadowland, and the return, after the taxes are paid, goes to the town to pay for municipal expenditure. In this reserve there are small vineyards which fail to give a crop, and various places subject to landslips, and frequently subject to floods from the river Basento which are too damaging to allow anything to grow. These are the goods enjoyed by the citizens of Grassano. [ASP, Intendenza di Basilicata, 618,1, copy of letter from the decusionati to the commissario, dated 10.4.1812, 2v-3v, translated].

More specific information is available on the Machitella district of the municipality, which had formerly been a feudal reserve. In 1813, the area was surveyed at 153.5 ha of which 46.8 ha (30.5%) was unusable because composed of riverbed, waterway and gulley, or trackway (ASP, Intendenza di Basilicata, 619, 15, Ordinance: "Coppia ec. - Estrato dal suo originale sintente nella Segretaria dell'Intendenza di Basilicata...").

The roads around the town were affected by landslides, and as the network of roads grew, so too did damage to the roads. The 1839 report by the Engineer of Water and Roads claimed that any roads connecting the proposed road to Grassano and Grottole would be too steep, too winding, and probably prone to disruption by landslides (ASP, Intendenza di Basilicata (1806-1860), 50, 151, letter from L'Ingegnere di Acqua e Strade to the intendente, dated 11.6.1839). As in the rest of Basilicata repairs to the roads were often necessary after heavy rain. For instance, in February 1851 the Repullone road was being "daily devastated by the continuing rain" (ASP, Intendenza di Basilicata, 1006, 619, "Delibera dei Decusionati del Comune di Grassano" dated 18.2.1851, translated). Some damage was caused by landslides. In 1843, for example, a proposal was made for spending a total of D78.41 [*approximately L2.2 million at 1988 prices*] on repairing the Scalone road, of which D1.44 [*approximately L40,000*] was for "excavation" (ASP, Intendenza di Basilicata, 1006, 619, "Progetto, a stato definitivo, ad astimatorea de lavori occorenti per la riparazione della pubblica strada distinta [?] nell'abitato di Grassano denominata Scalone").

One possible indication of damage by landslides to Grassano is that it was reported in 1808 that "Vigilance is used over the fallen houses" in the town which posed a threat to public health (ASN, Ministero Interno, I, 2183, 3, 19r, translated). The reason why the houses were damaged is unknown, but may have been the result of a landslide.

The railway along the Basento valley proved particularly vulnerable to landslides. On 20 October 1888 a train which had just left Grassano station was derailed by a landslide in the municipality of Salandra. Several were killed (Almagià, 1910; Di Sanza, 1925; Puglisi, 1977).

By the beginning of the twentieth century, a number of areas in and around Grassano were evidently subject to land degradation and landslides This impression is confirmed by more recently documentary evidence on Grassano which shows that during the twentieth century urban landslides have become a serious problem.

6.3 Landslides in the twentieth century

In 1904 Grassano was scheduled for consolidation by the government (Regione Basilicata, 1987). Almagià (1910) described Grassano's landslides at that time and concluded that the problem from the landslides to the south and north of the town was worsening - but that the town itself was not seriously threatened. The implication that although there were landslides threatening the town the hazard was less severe than it is today, is corroborated by three main pieces of evidence:

First, in 1906 the mayor of Grassano wrote to the Prefect of Basilicata about the danger to dwellings threatened by collapse. This letter's measured tone was indicative of a problem that was serious but not perceived as urgent.

> There are numerous inhabited houses built on top of cellars and caves and they are found on a section of about 400 m along the northern edge of the town. To forestall the danger coming from the collapse of the rock mass on which they are built, several engineers have come here, and they believed it necessary to undertake large-scale works under the provisions for Basilicata [the Zanardelli law of 1904]. Similarly, there are also another 50 homes which are on top of a dangerous rock mass in the south... In the centre of the town there are at points cellars [?] which could endanger the buildings above them, but there seems no urgency for now. [ASP, Prefettura di Potenza, Gabinetto, I, 280, letter from the sindaco to the prefetto, dated 22.5.1906, translated.]

Second, a similar picture of the town is given in the document (possibly, in fact, based on this letter) ASP, Prefettura di Potenza, Gabinetto, I, 280, "Condizioni di Stabilità degli Abitati - (Circ. 3/2 n 169)", translated). Grassano's stability was simply described as follows: "There is danger but there aren't means [for its solution]".

Third, and most significant, was a fairly detailed description apparently written in 1902, by engineer Guercia of the Genio Civile. The earliest version appears at ASP, Prefettura, Atti Amministrativi (1896-1907), 213, 11, letter from the Genio Civile to the prefetto, dated 3.6.1902. It was subsequently expanded (ASM, Genio Civile, I, report dated 22.10.1906); and with an additional concluding paragraph at ASP, Prefettura di Potenza, Gabinetto, I, 280, letter dated 26.10.1906. The report described a number of landslides, and noted that the worst problem was caused by the collapse of the cellars (which still exist) excavated under the town. The meticulous care taken to list the effects of landslides in Grassano is evident, yet the opening line of the report revealed that the problem was not perceived as severe:

> "In general, the town of Grassano is in a good condition of stability; with the exception of the northern edge and in particular places where, not because of the geological structure of the subsoil, but because of the work of the hand of man [sic] there is danger from landslides. The town is situated on top of a conglomerate mass with an average thickness of 7.00 m which rests on disassociated sandstones which are exposed on the northern side of the greater steepness of the slope. On this side, from time immemorial, the inhabitants of the place have excavated and continue to excavate caves for use as cellars. Towards the municipal road [Cinti] these caves have two floors and by the Chiesa Madre in some places are cut either partly into the conglomerate or entirely into the sandstone without any reinforcing support. Only near the entrances are there any props and stone supports. The action of the atmosphere slowly works on the weak cement and breaks it down, especially in the fronts cut into sand, in such a way that the overhanging rock comes to lack any base, and tumbles.
>
> "This is made easier either by the action of the water percolating through the conglomerate... or by the lack of base for the soil in which the caves are excavated, and that is without any method, in any direction, in such a way that one penetrates into another. About thirty-five years ago a part of the conglomerate on which the Chiesa Madre sits, the highest part of the town, collapsed. Now a number of other caves are no longer being cut in that area, nevertheless it is necessary to forbid any excavation carried out in the caves in the sandstone.
>
> "Eight years ago there was a landslide which buried and destroyed the cellars of two proprietors. In this same area in 1901, another piece of sandstone fell, burying another two cellars. Finally in 1902, a large piece of conglomerate fell from above, damaging other cellars and dropping down interrupted travel on the Cinti municipal road, where it damaged the vineyards and vegetable gardens; another rocky mass, through lack of underlying support and because it was detached along a natural fissure, threatened to fall. This rock was about 20.00 m long, 7.00 m high and 10.00 m deep and threatened to ruin various cellars and the livelihoods of the [illegible]. Following a visit from this office there were [illegible] for it to be pulled down.

"Besides the Tortorelli cellar, which lies underneath the Chiesa Madre oriented north-south and about 80 m long, there there is a segment of conglomerate which comes to the surface in the Piazza area, near the main road of the town, [Corso] Umberto Primo. The church is built on this segment, and at the top of its southern side there is Vincolo Primo Chiesa. This side is in complete disrepair and there are also some deep caves, dug there in such a way that the houses above them are in continuous danger."

The report of our office shows that the main, if not the unique cause of the danger which threatens this town comes from the cellars dug in the past without rational criteria, badly maintained and winding which weaken the conglomerate in which one finds there. While waiting for works which can fully consolidate the built-up area, carrying out the law on Basilicata, it is necessary that you allow immediate and necessary ordinances in terms of Article 151 of [illegible abbreviation] such as the [illegible], the shoring-up or the demolition of the biggest cellars to avoid probable serious accidents.

The information in the document was not updated from the 1902 original. There was no mention, for instance, of the landslide of 1904 which affected the Rione San Sofia (ASM, Genio Civile, I, 826, "Elenco dei danni verificati ale opere comunali ed ai privati propriatarî a causa di alluvioni e frane verificatosi dal 1° Gennaio 1904"). An interview with the former mayor Thomasso Celiberti gave supporting evidence that by 1910 it was understood that Grassano was vulnerable. Celiberti recalled seeing a report on the town produced by the Genio Civile (possibly that quoted above). It described the western side of Grassano (the site of the Calvario landslide) as unstable. Celiberti claimed to have acted on this information in encouraging the eastward development of the town after the last world war - but this document has proved impossible to find, and has probably been lost.

6.3.1 Landslides from 1900 until the 1930s

6.3.1.1 The 1902 Cinti landslide

The first event this century for which there is corroborating evidence is the 1902 landslide which affected the Via Cinti. It was apparently referred to in the 1906 Genio Civile report, and also probably referred to in passing by Almagià (1910, 158). The threat from the landslide was discussed by the Municipal Giunta of Grassano on 24 April 1902 (AMG, Deliberazioni della Giunta Municipale, 1902, 66, translated):

The President [of the Giunta] Sig. Domenico Tortorelli... has invited a statement on how to prevent the severe danger to the citizens who cross the Cinti district, on one of the main roads close to the town. Everyone knows that in March a boulder of some tonnes fell though fortunately did not cause a serious accident. In

> the meantime, another larger portion of the rock is threatening [illegible] and it is impossible to forsee the precise consequences. Perhaps it could bring the houses above it tumbling down

6.3.1.2 The 1903 Via San Sofia landslide

The next recorded landslide occurred in Via San Sofia - probably in 1903. Two slightly different versions of events exist. The first is a report by the Commander of the Carabinieri, Potenza Division (ASP, Prefettura di Potenza, 213, 11, letter from the Legione Territoriale dei Carabinieri Reali di Bari, dated 5.1.1904, translated), described the events as follows:

> Towards 10 a.m. on December 21 in the town of Grassano, in Via San Sofia a large mass of rock collapsed which had underlain part of an unoccupied house belonging to Concetta Pentasciglio.
>
> The falling mass struck a building belonging to the heirs of Carlo Bonelli, as well as a cellar belonging to Maddalena Viroscutino.
>
> There were no victims save a mule, valued at L350, belonging to Giuseppe Albanese, which was buried under the masonry. The loss produced by the relevant landslide is up to L2,000 [*L8,210,000*] taking into account the damage to the buildings and farms.

The second (ASM, Genio Civile, I, 836, "Elenco dei danni verificati alle opere comunali ed ai propreatarî a causa di alluvioni e frane manifestosi dal 1° Gennaio 1904") states that a heavy storm on new year's day 1904 caused an estimated L1,500 of damage [*L6,150,000 at 1988 prices*]. Three houses in Rione San Sofia [now Via San Sofia] collapsed after a slippage in the underlying sandstone, which forms a part of the headscar of the paleoslide. The houses damaged belonged to Concetta Pentasciglio (L300 damage), Giovanni Bonelli (L100 damage), and Gerendo Falcone (L300 damage). Flooding damaged two cellars in the town (a total of L400 damage) and seven plots of land were also damaged - probably by small landslips (a total of L700 damage). In all, eight households lost their accommodation.

6.3.1.3 The 1907 landslides

The impression that landslides had a relatively limited impact on the town itself is confirmed by the correspondence about the town from 1907. In February that year storms caused heavy damage throughout Basilicata. The Prefect of Potenza was in contact with thirty-two of the 125 mayors in the region, including the Mayor of Grassano (ibid, "Sindaci a cui si è telegrafato"). Eighteen of the municipalities in the hundred (*circondario*) of Matera, which included Grassano, were damaged by landslides

(ASP, Prefettura di Potenza, Gabinetto, I, 278, "Danni prodotti dalle alluvioni e dalle frane del febbraio 1907 - Circondario di Matera").

The first reference to events at Grassano is a telegram from the mayor to the prefect indicates that landslides cut a number of roads - including the provincial road (now known as the SS7) which was probably as a result of landslides in the Petrino and/or Caracoia areas. "I understand that interruptions [on the road] cut the town off and nobody can get past them. Today I will find out if we can get some sort of postal service." (Ibid, telegram number 5 of 13.2.1907, from the sindaco to the prefetto.)

By the following day the extent of the problem was clearer. "After an examination carried out yesterday along the bridleway leading to the [illegible] railway station, which was blocked by the first landslide, it appears that once past the landslides it is possible to get to the provincial road across the fields, which is unaffected by landslides. By this road one can get on horseback to the station. Today I sent labourers to get rid of the debris. I will carry out work under provincial direction. Send expenses." (Ibid, letter from the sindaco to the prefetto, dated 14.2.1907.)

The damaged area did not include any part of the town (ibid, "Danni prodotti dalle alluvioni e dalle frane del febbraio 1907 - Circondario di Matera"), but it was more extensive than at first thought. The mayor later wrote to the prefect asking for government aid (ASP, Prefettura di Potenza, Gabinetto, I, 279, letter from the sindaco to the prefetto, dated 7.3.1907):

> The roads outside of the built-up area of this municipality were not a little damaged by the recent storms.
>
> In fact almost all the bridleways, particularly those leading to the railway station, to the Bilioso torrent, the Basento river, to the private holdings, were made inaccessible by landslides.

6.3.1.4 Later landslides, 1907 to 1930

Some evidence is available on the impact of landslides in Grassano between 1907 and the 1930s, from which time the Calvario landslide became increasingly active.

In 1913 a total of L400 [*L1,440,000*] was paid to the town to buy land for consolidation works. The exact location is not recorded, but the consolidation seems to have followed a landslide in the town. The Council Deliberation which authorized payment for the consolidation work noted that "there are other urgent consolidation works necessary in numerous other landslide-prone areas near to the town" (AMG, Deliberazione del Consiglio Communale, 1913, 24, translated).

Similar work became necessary in the area of the Chiesa Madre. Between 1922 and 1925 consolidation work was carried out on a retaining wall near the church (ASM, Genio Civile, I, 395, folder: *Opere di consolidamento delle frane minnacianti gli abitanti: lavoro di consolidamento dell'abitato di Grassano: Ricostruzione del muro di sostegno del piazzale del Chiesa Madre*).

During December 1927, and with particular intensity on 3 January 1928, heavy storms again caused damage in the town. The stability of a block of conglomerate and sandstone overhanging Corso Umberto Primo caused sufficient concern that it was demolished (ASM, Genio Civile, I, 395, "Perizia urgente per abattimento di massa pericolante sotto il vico III Chiesa e di robustimento della balza rocciosa", dated 23.3.1928). Work was again necessary on the same site for the same reason after the storms of 1930 and 1931 - notably that of 29 November 1930 (ASM, Genio Civile, I, 347, folder: *Lavori urgenti per l'abattimento di massi pericolanti sotto il Vico III Chiesa e di robustimento della balza rocciosa adiacente per il consolidamento dell'abitato di Grassano a seguito dell'inverno 1930-31*).

6.3.2 Other minor landslides

Landslides are evident throughout the area of the municipality - most notably on the clay hills studied by Rendell (unpublished, 1975) as can be seen from the geotechnical data reported in the previous chapter. A number of historical documents show that several problems were recognized in these areas by the 1950s - but were not recorded until the growth of government allowed reclamation to take place.

The areas of the municipality which were chosen for reclamation, from the 1950s onwards, were usually those subject to extensive land degradation and often to landslides. The precise frequency of landslides is hard to determine, though many of the areas were described as prone to calanchi, implying the continuous erosion and landslides associated with that landform. In 1961, for example, the gulleys of the Cugno di Noce area were threatened by instability. If they were not prevented from deepening, landslides would inevitably result, it was claimed (AMG, file: *Cantiere Rimboschimento N. 19336/R*, "Relazione tecnica illustrata").

The hillsides around Grassano were reported in the 1960s as extensively degraded (ASM, Genio Civile, III, 115, 521). In 1961 the Consorzio di Bonifica della Media Valle del Bradano carried out a reclamation project in the municipalities of Grassano, Grottole, and Miglionico. At that time the situation on the Bilioso slope of the interfluve on which the towns stand was clearly poor and, as at Cugno di Noce, deteriorating rapidly:

> In fact, though with the intervention already carried out, good results have been obtained on those slopes where work was done. At the moment, as well as new rills which previously were not there or were unimportant, there are also several areas which cannot be abandoned but are unstable or actually subject to landslides. This has happened either because of the weather, particularly disastrous in these last years, or because of the heedlessness of the cultivators who could have intervened with simple measures to stop the incipient erosion. [Ibid, "Relazione", 2-3, translated.]

Many of the roads around Grassano have been affected by persistent landslides because they are poorly protected from erosion (see *Gazzetta del Mezzogiorno*, 1983). The SS7 has been affected by continuous landslides in the Caracoia area (*Gazzetta del Mezzogiorno*, 1984b; 1984c). Building the Mulino road was hindered by landslides (Vignola, N [1943-], unpublished, 1981). Since its construction in the 1980s the road and its feeders have been subject to repeated damage (see *Gazzetta del Mezzogiorno*, 1983). The road was damaged as recently as 1991 (*Gazzetta del Mezzogiorno*, 1991).

Drought and fire have been significant contributors to land degradation. In 1976, the Consorzio di Bonifica di Bradano e Metaponto reported the need to reforest 27.9072 ha of trees burnt during the drought of 1974 - about 60% of which was in Grassano (ASM, Genio Civile, III, 33, 160, "Relazione"). In 1981, Mayor Vignola [1943-] reported that all of the reforested land in Grassano had been lost to fire (Vignola, N [1943-], unpublished, 1981).

6.3.3 Urban landslides

6.3.3.1 The Cinti landslide

Minor landslides in and near the town have been a persistent problem throughout this century. One such example was the landslide in the Cinti district, which recurred in late 1959, or early 1960. The landslide was recorded in a letter from the mayor in 1960, but no documents were found on what was done.

> Immediately adjacent to the built-up area a landslide has occurred in the district called "Cinti". It has caused a drop of about 3 metres over an area of about one hectare.
>
> Since this landslide could extend and affect the built-up area, I request that your office [the Genio Civile] should carry out an inspection. [ASM, Provveditorato alle Opere Pubbliche, I, 177, letter from the sindaco to the Genio Civile, dated 28.1.1960, translated.]

6.3.3.2 The Via Capolegrotte landslide

Via Capolegrotte is part of the conglomerate lip of the paleolandslide scar overhanging the Corso Umberto Primo and Via Vittorio Emanuele Secondo, and was already affected by a landslide in 1927 (section 6.3.1.4). From the 1970s, the deterioration of conditions there once again gave cause for concern. After a landslide affected the area in 1971, the town council described it as a threat to the whole town centre (AMG, Deliberazioni del Consiglio Comunale, 1971, 68).

According to a letter of July 1980, a group of forty-four locals wrote on three occasions to the town hall (AMG, Anno 1978, X, 2, 13, letter from Antonio Lacertose and forty-three others to the Genio Civile, dated 26.7.1980 - it proved impossible to find a copy of the first letter, apparently dated 29.8.1976). The problem was, as set out in an earlier letter of July 1977, in Vico Primo Capolegrotte (AMG, Anno 1977, X, 2, 13, letter from Domenico Villano and forty-two others to the prefetto, dated from internal evidence as July 1977, translated). "There is a wall to restrain an overhanging mass, the wall built in two parts, with the rock sticking out over the road, and recently several rocks have fallen, with extreme danger to passers-by." (Although the letter was apparently drafted in July 1977, the 1980 letter mentions a letter written and "signed as always by a large number of citizens" dated 29.5.1977.)

6.3.3.3 The Petrino landslide

The Petrino landslide is a segment of the paleoslide to the immediate west of the town, on the SS7. The landslide is a longstanding problem (interviews; *Gazzetta del Mezzogiorno*, 1985b) and as already reported may well have been moving since at least 1907 (section 6.3.1.3). In 1961, when the plans for a new road connecting Grassano to Matera were made (ASM, Genio Civile, III, 223, 761) the existing roads in the area were described as "cut by numerous landslides" (ibid, "Relazione", translated).

The landslide became more serious by the mid-1980s. In January 1985 there was a major slippage (*Gazzetta del Mezzogiorno,* 1986a). In March 1985 the *Gazzetta del Mezzogiorno* (1985b) reported that the road had been damaged by slippages at three places. Traffic along the SS7 was interrupted for five months (*Gazzetta del Mezzogiorno,* 1985c). Later that year it was reported that there were fears the whole road might be lost (*Gazzetta del Mezzogiorno,* 1985e).

The problem had still not been solved the following year. Mayor Incampo was interviewed by the *Gazzetta del Mezzogiorno* (1986a, translated) and complained about the delays over repairs: "The delay is serious. This is a historic and important road." There was a further, small movement in spring 1987. Funding has now arrived for major repairs to the road and reinforcement against future slope movements. L471 million was allocated in 1987 and a project costing a further L1.8 billion was begun in 1990 (see appendix C).

6.3.3.4 Other landslides

Problems of instability have continued in the town centre to the 1980s, if less severe than those during the period at the start of the century. Engineer Dichio recorded (personal communication) that one home had been evacuated because of a landslide in the town in the period 1984 to 1988. Two houses also collapsed in the town centre in 1988: earthquake damage had destroyed their neighbours in 1980 but neither had been buttressed.

6.3.4 The Calvario landslide

The landslide in the Calvario district (figure 6.1) is undercut by the erosion to the south of Grassano, and in 1906 was referred to by the mayor as subject to landslides (ASP, Prefettura di Potenza, Gabinetto, I, 280, letter from the sindaco to the prefetto, dated 22.5.1906, translated). Landslides became more serious later when erosion, accelerated by sewage drainage, meant that the area's slopes were made progressively less stable.

The first definite evidence of a landslide in the area was in 1934 when the SS7 was damaged. In that year Grassano was hit by intense storms and a large number of repairs had to be carried out: the cemetery, the Fontana, and Vecchio Trattura areas, the Fossa Tilea, Strada Fontana, the SS7, Via Chiesa, Fontana Piccola Tilea, Fontana Grande Tilea, and Via Madonna della Neve (ASM, Genio Civile, I, 347, file: *Lavori di riparazione danni prodotti dalle alluvione del 1934 delle opere di consolidamento di Grassano*). Damage to the Fontana, the SS7, and Via Madonna delle Neve, combined with the evidence from elsewhere (ASM, Genio Civile, I, 347, file: *Via Puntone*, letter from the podestà to the Genio Civile, dated 22.8.1934) suggests a movement of the Calvario landslide. A later letter shows that a visit was made by an official of the Genio Civile on 23 June 1934 who confirmed there was a deep landslide (ASM, Genio Civile, I, 482, letter from the Genio Civile to the Prefettura, dated 17.12.1941).

The matter was treated seriously by the town's administrators. On August 22 the mayor wrote to the Genio Civile at Matera to remind them that: "Some time ago, in the Puntone area [the area of the Calvario landslide] of this town, a landslide occurred... I believe that urgent consolidation work is necessary..." (ASM, Genio Civile, I, 347, letter from the podestà to the Genio Civile, dated 22.8.1934, translated.) It is known that on Saturday August 25 the Genio Civile arranged the inspection for the following Monday (ibid, letter from the Genio Civile to the podestà, dated 25.8.1934), but no record could be found of the inspection.

The problem recurred the following year. In March 1935 a Genio Civile report stated that:

> in the Calvario area, lower part of the town of Grassano, a small landslide has occurred; it has caused a slight lowering of the road with lesions to the surrounding houses.
>
> For the moment the landslide does not look serious, but with more torrential rain it could cause the sliding of the above mentioned area." [ASM, Genio Civile, I, 395, report by Michele Veneziani to the Genio Civile, dated 16.3.1935, translated.]

The first evidence of significant damage in the Calvario area came in June 1939 (AMG, Anni 1939-40-41, X, 6, 1, letter from the Genio Civile to the Prefettura, dated 3.6.1939, translated). The visiting engineer reported that "in Via Apullo Lucana part of the roof of number 24, a single-storey building, has collapsed... In the Calvario area there have been no more recent events, but as a matter of prudence it is advisable to evacuate numbers 21, 22, and 23 Via Garibaldi..." On June 8, The prefect wrote to the mayor requesting the damaged houses be evacuated (AMG, Anni 1939-40-41, X, 6, 1, letter from the prefetto to the podestà, dated 8.6.1939).

Similar problems occurred in January 1940 when heavy rains fell on Grassano and reactivated the landslide, causing the collapse of retaining walls (ASM, Genio Civile, I, 482, document: "Perizia dei lavori di pronto soccorso da eseguire al rione Calvario dell'abitato di Grassano", dated 14.3.1940).

The landslide came to the attention of the Secretary of the Federazione dei Fascisti di Combattimento, Matera - who, alarmed that it was a worsening problem, wrote: "From Grassano, I have been made aware of the necessity of carrying out some consolidation works in the Piano Favale and Calvario area, evidently threatened, so I am told, by an ever-progressing landslide..." (ASM, Genio Civile, I, 482, letter from the Segretario Federale, Federazione dei Fascisti di Combattimento to the Ingegnere Capo del Genio Civile, dated 16.8. Fascist Year XVIII [1940], translated.)

Following a report by Surveyor Lagonigro of Grassano the urgent evacuation of five houses in the Calvario area was deemed necessary (AMG, Anni 1939-40-41, X, 6, 1, letter from the podestà to the prefetto, dated 29.10.1940). The figure of five evacuated homes is confirmed by AMG, Anni 1939-40-41, X, 6, 1, letter from the podestà to the prefetto, dated 29.10.1940. In addition to the evacuation the mayor claimed that "urgent work is required to ensure that all of the huge Calvario district does not become uninhabitable." (AMG, Anni, 1939-40-41, X, 6, 1, letter from the podestà to the prefetto, dated 29.10.1940, translated.)

The threat from the Calvario landslide continued to concern the authorities. As part of a series of projects during the 1940s a 15.4-m-long retaining wall was built on the edge of the district at the corner of Via Meridionale and Via Garibaldi, in order to protect the steep slope there against movement (ASM, Genio Civile, I, 482, folder: *Grassano: consolidamento rione Purgatorio ecc.*, "Perizia dei lavori di consolidamento del rione Purgatorio, della via S. Lucia, de largo Puntone e del fosso Fontana dello abitato di Grassano").

In both 1942 and 1950, the Calvario landslide disrupted traffic entering the town. On 3 April 1942 the prefectoral commissioner (acting as mayor) reported: "Following the recent continuous rain, the Calvario district landslide in this municipality has become more alarming, and moreover a serious crack has opened underneath the small bridge of the Viale della Rimembrenza (close to Largo Pontone) as a result of which I

Figure 6.1: Grassano: the Calvario district

have arranged that the lorries and other vehicles should pass only on one side of the road" (ASM, Genio Civile, I, 482, letter from the commissario prefitizio to the Genio Civile, dated 3.4.1942, translated). In 1950 the problem recurred (AMG, Anno 1950, X, 1, 4, letter from the sindaco to the Genio Civile, dated 4.8.1950, translated). "In the Puntone-Calvario area, where the cellars of the Stigliano family were, underneath the home of Antonio Rapanaro, a landslide threatens danger to the houses above it and to the road 'Viale della Rimembrenza' where all the coaches and motor vehicles etc. enter the town."

The most dramatic movement of the landslide in the Calvario area was in 1956, which appears to have been by far the most serious landslide then to have affected Grassano. The Calvario landslide was the first landslide to receive major public attention. A number of older people interviewed in 1988 still remembered it. Michele reported in an interview that 90 families had been forced to abandon their homes. He had a friend who, after the event, built himself a new house on Via Meridionale. Some experiences were more dramatic. Beatrice: "Really nearly everything in Calvà [Calvario], everything tumbled down... Years ago." (Her mother's house had been in the Calvario area, on Via Appulo Lucano. It had partly collapsed, then been demolished.) Giacinto said the Calvario landslide was "a brutally ugly thing": a stain on the town. Though his friend disagreed - Giacinto was exaggerating, he said. Antonia's neighbour had lived at the bottom of Via Meridionale. His part of the road had been cracked. He had had to evacuate his house with his family. They rented a house nearby. He remembered that after the landslide many of the younger local people had left the town.

The Calvario landslide was preceded by a small earthquake of MS VII, with its epicentre just south of Grassano (Calcagnile and others, 1987; Regione Basilicata, 1987). In the twenty-four hours before the event there was about 1,000 mm of snow (Del Prete, 1981). The fullest description is an untitled transcript in the municipal archives at Grassano (AMG, file: *Frana del 1956*, untitled description of the landslide dated 14.3.1956 [apparently a slip of the pen for 14 February 1956], translated).

> March 14 [sic] in Grassano, the subsequently-described executive engineer of the Genio Civile of Matera, together with the commander of the 50th Corps of the Fire Brigade of Matera, with Alderman Sig. Giuseppe Vignola and with the municipal secretary of Grassano Dr. Luigi Voltini, carried out an inspection of the area affected by the landslide which occurred between 4 and 6 a.m. of that day, to this effect:
>
> The landslide caused a drop in the level of the SS7 road of about 70 cm, for a length of about 45 m. This drop was caused by the landslide occurring below the road and which affected about 15 ha.

> The landslide extends uphill of the state road at a depth of about 50 m, coming out by the nearest buildings of the Calvario area, the closest of which to the landslide shows signs of dissection...

Initial evacuation was carried out by the police, according to the report on February 15 in the *Gazzetta del Mezzogiorno* (1956a, translated). "At Grassano the police have evacuated around thirty houses in danger of collapse. The cause was the weight of the fallen snow, and erosion from meltwater." On the following day wholesale evacuation was ordered, based on the areas outlined in the report (AMG, Ordinanze del Sindaco, dated 15.2.1956). Initially, 77 households were evacuated - of which 34 were from Via Calvario, 13 from Via Garibaldi, 12 from Via Appulo Lucana, 12 from Via Sant'Innocenzo, 4 from Via Gianvincenzo, and 2 from Via Santa Lucia (AMG, file: *Frana del 1956*, document: "Case sinistrate in seguito di scivolamento di terreno franoso").

A telegram in the same file, sent by the mayor to the prefect, gives a slightly different picture: "Ninety-seven families and 150 rooms evacuated stop another ten rooms evacuated in town centre because dangerous stop seven infant schools with fourteen classes closed because they are dangerous stop..." (AMG, file: *Frana del 1956*, text of a telegram sent from the sindaco to the prefetto, dated 16.2.1956, translated). According to the *Gazzetta del Mezzogiorno* (1956b, translated) 150 families were evacuated. "At Grassano a landslide has occurred above and below the SS7. It has affected 15 ha, with 150 families and as many dwellings evacuated. The families have been lodged in vacant buildings."

Once reactivated, the debris of the Calvario landslide remained only marginally stable. After the drama of 1956 the landslide moved at least twice more in the following twenty-two months. In early 1957 further, slight movements took place, and a Genio Civile report gave the following description:

> On February 2 this year, officials of this office carried out an examining visit to discover the latest results of the landslide which affected the Calvario area, on the edge of this town on 14 February 1956.
>
> A more recent, continuous - if slight - movement of the landslide was observed which had caused the enlarging of old lesions, as well as brand new ones and the rupturing of some glass rods put in place by this office in order to monitor the changing situation. [AMG, file: *Frana del 1956*, letter from the Genio Civile to the Municipality of Grassano, dated 7.2.1957, translated.]

In December 1957 there was a further serious movement after heavy rain, affecting the SS7. The press, exaggerating the seriousness of the event, described it as follows:

> ALARMING SITUATION IN THE PROVINCE OF MATERA
> GRASSANO IN DANGER FROM A HUGE LANDSLIDE

> MATERA, 30th (G. M.) - Towards half-past eight this morning the area affected by a landslide in the built-up part of the municipality of Grassano - which about three years ago [in fact this refers to the events of 1956] was affected by landslides and an earthquake - was put into rapid motion.
>
> At noon, for a length of almost 100 metres a large area of ground was lowered by almost one metre, sliding slowly downhill.
>
> The slippage affected the the Via Appia, SS7, so traffic was diverted via the town itself. The landslide threatened the immediate collapse of a group of houses evacuated some time ago.
>
> The event occurred following the recent rains which, innevitably, are continuing without intermission.
>
> The mayor, together with other municipal officials, arrived at the scene immediately; meanwhile the arrival of the Genio Civile is awaited. [*Il Giornale d'Italia*, 1957, translated. The report in the *Gazzetta del Mezzogiorno* was almost identical]

The report in *Il Tempo* was slightly less clamorous:

> HUGE LANDSLIDE
> in the town of Grassano
>
> Matera, December 30
> (E.P.) - the landslide area affecting the town of Grassano, which about three years ago [the same error] was affected by a landslide and an earthquake, is moving rapidly again. At noon, for a length of almost 100 metres, a huge quantity of earth, without any surface signs of movement, dropped by almost one metre, sliding slowly downhill.
>
> ...The event occurred following the recent rains which are continuing without intermission; it seems serious, to such an extent that from its very onset it provoked panic among the people living nearby. [*Il Tempo*, 1957, translated.]

The Genio Civile report of the following day shows the landslide to have been serious, but smaller than both the alarming reports in the press implied. "A length of about 30 m of the said road, at the edge of the town, has dropped by about one metre with subsequent interruptions to the traffic, which has been diverted across the town." (AMG, 1958, 10, 1, 4, letter from the Ingegnere Dirigente of the Genio Civile to the Prefettura, dated 31.12.1957, translated.)

In 1959, triggered once again by heavy rain, the condition of several of the buildings worsened considerably and waterpipes were ruptured, further saturating the underlying subsoil. The mayor was forced to issue a demolition order (AMG, file: *Frana del 1956*, letter from the prefetto to the sindaco, dated 4.12.1959). The danger was described as being "landsliding and erosion of the road surface, severe damage to drinking water pipes". (ASM, Provveditore alle Opere Pubbliche, I, 177, letter from

Ing. Ancora to Impressa DONATONE Luigi, dated 28.11.1959, translated.) In the same letter, "about sixty-six" houses are described as having lesions, "about ten" as in need of demolition.

The damage from the storms of winter 1959 seems to have affected much of the town. The mayor notified the Genio Civile of the damage in a letter dated November 26.

> I write to say that as a result of the recent cloudbursts which occurred in the area, there has been the following damage:
> Cracks in the walls of the houses on the edge of the landslide, beyond those already produced by the above movement, which has made their demolition necessary;
> destruction of some water pipes running along the streets, to be specific: Via Sant'Innocenzo, Via Santa Maria la Neve [sic], and Corso Umberto Primo;
> subsidence and deep cracks on the highway along the following roads: Via Sotto Santo Domenico to the State Road 7, Via Sant'Innocenzo, Via Santa Maria della Neve, Corso Umberto Primo, and the road in the new area of Via Capitano Pirrone;
> a landslide on the Spineto road;
> erosion and the washing away of huge areas of land on the banks of the "Basento" river;
> a landslide on the Via Tilea which connects the built-up area with the Pianella, Processa, Calderaso and Manche districts. [AMG, 1959, X, 2, 1, letter from the sindaco to the Genio Civile, dated 26.11.1959, translated.]

The most recently recorded major landslide in the Calvario area was on 13 January 1960. Deputy-Mayor Lopergolo sent a telegram to the Genio Civile informing them that: "A new landslide has affected the Calvario area and the SS7 road causing damage to buildings and making the road impassable stop please send a technician from the Genio Civile". (AMG, Anno 1959, X, 2, 8, telegram from the vice-sindaco to the Genio Civile, dated 13.1.1960, translated.) The Genio Civile inspected the problem and reported:

> There has been a new movement of the old landslide which has caused a serious lowering of a 60-metre length of the SS7 road by about 1.70 m.
>
> The landslide, which is about 90 m from top to bottom and extends up and downslope of the road, has caused new damage to homes in the Calvario district of the town. [ASM, Prefettura di Potenza, Gabinetto, III, 110, 1808, letter from the Genio Civile to the Provveditorato Regionale alle Opere Pubbliche, dated 15.1.1960, translated.]

After the events of 1960, the affected parts of the Calvario area were evacuated. Over thirty dwellings eventually collapsed as a result of the landslide, it was reported in 1963 (ASM, Provveditorato delle Opere Pubbliche, I, 177, letter from the sindaco to the Cassa per il Mezzogiorno, dated 10.10.1963). A few residents stayed on, though in 1969 the planning officer Lapacciana described the Calvario area being abandoned and uninhabited (AMG, file: *Frana del 1956*, statement by the Tecnico Communale, dated 12.11.1969). Some damage has continued in the area and a number of buildings collapsed. Lapacciana quoted the collapse of Giuseppe Tortorelli's house in his statement (ibid), and a letter from Felice Rapanaro to the mayor in 1964 indicated that movement was continuing close to the scar of the landslide (AMG, Anno 1964, X, 2, 8, letter from Rapanaro Felice to the sindaco, dated 20.7.1964). Minor movements still occur (Cotecchia and Del Prete, 1992) but no significant damage has since been done to the buildings.

6.3.5 The Cemetery landslide

The cemetery is of great importance to the communal life of Grassano. In 1948 the mayor had referred to it as the focal point for the "cult of the dead" (ASM, Genio Civile, I, 208, letter from the sindaco to the Provveditorato Regionale alle Opere Pubbliche, dated 28.7.1948, translated); and Camera dei Deputati (1954, 129, photo caption, translated) described it as "perhaps the most important part of the town". Consequently, the effect of the landslides there (figure 6.2) has had a deeply shocking effect on the local people.

The area around the cemetery, incized by the Fosso Fontana and the Fosso Marruggio Secondo, has been recognized as vulnerable to landslides for many years. The first damage recorded was in 1934: following storms which affected the access road and the cemetery itself (ASM, Genio Civile, I, 347, file: *Lavori per riparazione danni prodotti dalle alluvioni del 1934 delle opere di consolidamento di Grassano*). It was probably in the following year that the check dams referred to in the document were placed in the Fosso Fontana (ibid).

In 1947 it had been noted that, because of storms, damage continued and the check dams "had suffered undermining and cracking" (ASM, Genio Civile, I, 482, folder: *Grassano: consolidamento rione Purgatorio ecc.*, "Perizia dei lavori di consolidamento del rione Purgatorio, della via S. Lucia, de largo Puntone e del fosso Fontana dello abitato di Grassano", translated).

In 1948 the whole area was described as prone to landslides, and it was noted that the area had recently been affected by minor landslips. At that time, the cemetery was becoming too small for the requirements of the town. The mayor wrote to the

Figure 6.2: Grassano: the cemetery

Provveditorato Regionale alle Opere Pubbliche on the possibility of expanding the cemetery.

> Just downhill of the municipal cemetery being extremely prone to landslides, some time ago eleven check dams were constructed which, up until now, have given the area a certain stability and security.
>
> With the passing of time, in these parts as much as in the rest of Lucania, the storms are very violent and have led to damage which, as it stands, presents a severe threat to the cemetery's existence.
>
> ...This situation has been made worse by the most recent storm and there has been a small landslip at the bottom of the cemetery area... [ASM, Genio Civile, I, 208, letter from the sindaco to the Provveditorato alle Opere Pubbliche, dated 28.7.1948, translated.]

Infact the area was to be affected by frequent landslides. In January 1959, there was a landslide at the cemetery after heavy rain. An event which Ex-Mayor Ambrico recalled in an interview (17 May 1988). Ambrico sent a telegram to the Provveditorato delle Opere Pubbliche: "Landslide produced water infiltration has affected the cemetery area [stop] I request to arrange an inspection to assess [stop]" (ASM, Provveditorato Regionale alle Opere Pubbliche, I, 177, telegram number 6 of 29.1.1959, from Sindaco Ambrico to the Genio Civile, translated). No further documents were found concerning the event.

Minor damage to the cemetery and its infrastructure was frequent, as a petition dated 1971 shows. "The here underwritten request you to take precautionary measures at the cemetery, where the rainwater from other places damages the private tombs starting with that of Gregorio Bolettieri and all the path in front so I [sic] request you to intervene as soon as possible." (AMG, Anno 1971, X, 2, petition dated (by the local authority) 17.3.1971, translated.)

The problem recurred in the winter of 1972 to 1973. Between December 1972 and February 1973, almost all the public works were damaged, according to a statement by the planning officer Lapacciana. This included extensive damage to the cemetery. (UTMG, file: *Nuovo Cimitero*, "Perizia dei lavori di sistemazione della recinzione, muri di sostegno, casa del custode, viali e gradinate interne nel civico cimitero".) According to documents held in the town hall's technical office, this included the cemetery, where "damage was reported to the plots in the avenues and internal steps, to the area used for the caretaker's shelter" (UTMG, file: *Nuovo Cimitero*, document: "Perizia dei lavori di sistemazione della ricinzione, muri di sostegno, casa del custode, viale e gradinate cimitero nel civico cimitero", "Relazione", dated 6.5.1974, translated).

It is evident that the municipality was aware that the longterm stability of the cemetery was compromised by undercutting gulley erosion. In 1973 it was reported that erosion in the gulleys beneath the cemetery, caused by rainwater and sewage runoff, was continuously undercutting the land on which the cemetery was built (AMG, file: *Cantiere N⁰ 26751/R*, "Relazione tecnica illustrativa".)

In 1974, two years before the main landslide, a twenty-five-name petition was signed complaining about the effects of landslides in the Fosso Marruggio. "The underwritten citizens, all riparians of the Fosso 'Marruggio' request that the planning officer should be invited to survey the damage caused by a landslide. The said landslide has cut a piece of road, impeding the access of the riparians to their own plots. To be more exact, in order to be able to get over this part of the road it is necessary to cross the vineyards of the riparians..." (AMG, Anno 1974, X, 2, 13, petition dated 21.1.1974, translated.)

About 300 mm of rain fell in the twenty-four hours before the landslide of 21 November 1976 (Del Prete, 1981) and there were landslides throughout Basilicata - most notably at Pisticci (Regione Basilicata, 1987). Significant damage was done to the cemetery at Grassano. "At Grassano", reported the *Corriere della Sera* of November 22 (translated), "another landslide has destroyed a large part of the cemetery, near the Fosso Fontana". The local press provided more extensive coverage, although the first report in the *Gazzetta del Mezzogiorno*, on November 22 (1976a, translated), only made page sixteen.

> Grassano (Matera) 21 Nov.
> A huge landslide has affected the cemetery of the municipality of Grassano. Half of the area has dropped about ten metres, upsetting municipal sepulchres and private chapels. The mayor, with council staff, went to the site immediately to see the damage, which could be about a billion [lire]. He has asked for an immediate meeting with the regional government, the Prefectorate and the province in order to establish the repairs necessary and has contacted the Genio Civile of Matera.
>
> Senator Salerno, after he had visited the devastated graveyard, suggested that the Prime Minister, the Minister of Public Works and the Basilicata region should intervene.

The following day the event made page seven (*Gazzetta del Mezzogiorno*, 1976b, translated), with a photograph of the scene.

> A DROP OF TWENTY-FIVE METRES CAUSED BY THE LANDSLIDE...
>
> Grassano, November 22

> As already reported, a large landslide has affected over half of the area of the old and new cemetery, which dropped by over twenty-five metres, the council sepulchres and chapels have been disturbed in a terrifying fashion, and - if the rain continues to fall - the ground will slip from under the very feet of the local people.
>
> Already by the end of yesterday, a number of meetings took place at the town hall, presided over by Mayor Daraio, where all the [political] groups took part in order to decide the first course of action. Ordinances of evacuation were sent out to six families living on the edge of the landslide [from Via Tarranto - see UTMG, file: *Nuovo Cimitero*, letter from the Commandante Provinciale dei Vigili del Fuoco to the Sindaco di Grassano, dated 21.11,1976]. Today, with the agreement of the health authority, spray disinfection was carried out by the firemen supervised by Dr. Mastroroberto and by Dr. D'Alessandra in place of the provincial doctor.
>
> Furthermore a precautionary measure is in operation by qualified staff, to get the corpses out of the gulleys and rebury them in the part of the cemetery not affected by the landslide. The burning and urgent problem remains that of burying the corpses; it is genuinely to be hoped that in the near future there will not be any new deaths. To discuss this, a meeting - ending shortly before this piece was finished - was held with the most important provincial, regional, and technical authorities, including among others the president of the Regional Council, Senator Bardi, the regional assessore for health, Schettini, Assessore Viti, Regional Councillor Grieco and Senator Ziccardi - who has studied events from close at hand since yesterday. Representing the Genio Civile of Matera was Engineer Stragapede.

The landslide of 1976 was a very significant one for Grassano. The events proved unnerving for almost everyone, and by 1980 the unease helped force political changes which have led to the creation of a machinery for managing landslides. The landslide has not been repeated, though has experienced small movements as a result of the November 1980 earthquake and also major storms (UTMG; file: unnamed; document: "Concorso per i lavori di consolidamento diretto ad eliminare le situazioni di rischio connesse alle condizioni del suolo nei comuni di Aliano, Gorgoglione, Grassano, Grottole, Montalbano Jonico, Pomarico, Stigliano" [June 1990]). Small cracks are visible in the cemetery walls at 90° to the slope, also giving evidence of downslope movement.

6.4 Conclusions

This chapter has examined the information from Grassano on the reported level of landslides during the twentieth century. Chapter three showed that the reported level of landslides has increased across much of the region - chapter four showed there are well-documented physical and social factors which explain this trend, and chapter five confirmed that these factors have affected Grassano.

The evidence from this chapter shows that there has been a real increase in the intensity of landsliding at Grassano. During the twentieth century landslides have affected parts of Grassano which were either marginally affected or completely unaffected before. Twentieth-century landslides are consequently on an unprecedented scale, which confirms the circumstantial evidence given in previous chapters that there has been a real increase in the intensity of landslides.

However, the records on landslides show that the present century has also seen a much greater level of information recorded on even the smallest landslides. Whether this reflects merely an increase in interest in the landslides which occur, or whether it may be a symptom of modern society's greater intolerance to landslides is an important question. Any assessment of the most effective way to treat landslides must be aware of social perceptions of the hazard they pose, but must also be prepared to question the validity of that perception and the action that follows from it. This increase is dealt with in chapter seven.

Chapter 7: Managing landslides at Grassano

This chapter examines the scale of the response to the landslides at Grassano - why it has increased so significantly during the twentieth century, and what has been the impact of this changing response to the landslides.

7.1 Introduction

Chapters three and six of this dissertation showed that there has been a real increase in the intensity of landslides in Basilicata during the twentieth century: this is despite the increase in the effort and money spent on tackling landslides which was described in detail in chapters four and five. The reasons for the changed response to landslides lay partly in the increased incidents of landslides and partly in an increased sensitivity to those landslides which occurred.

Factors accounting for the increased sensitivity were outlined in chapter four: but it is only in the context of an intensive analysis of a case study that the causative mechanisms leading to this change can be examined. Increasingly important in the contingent factors affecting landslides at Grassano has been the cultural interpretation of the landslide hazard and the attempts to manage the land which follow from it. This is because these attempts express what Kirby (1990c, 284) called a "local discourse" on risks and hazards, negotiated between interests in the community, which determines how they are perceived and how they are treated (for other examples see Guidoboni, 1987; Mitchell, Devine, and Jagger, 1989).

7.2 The response to landslides

The modern management of hazards throughout Basilicata has been characterized by inertia and a slow response to change - as Bergeron (1991) demonstrated in his analysis of the 1980 earthquake. "In Basilicata", Nicola Vignola [1948-] commented "everything's done after the horse has bolted" (personal communication). According to Gaetano Ambrico (interview) "Intervention is only carried out when something's happened... Today they continue to carry out an episodic intervention, rather than an organic one." The need for an "organic" intervention, to respond in advance to landslides using both active and passive measures, and treat them as predictable and an everyday problem, has been missing until very recently from the projects for environmental protection.

The response to hazards, once it has finally taken place, has ensured that although the level of damage has increased with the greater intensity of landslides, the total effect has often been financially beneficial. Grassano has benefitted greatly from the money spent on it after disasters - most notably over recent years in the funds for rebuilding after the 1980 earthquake (see Bergeron, 1991). At Grassano, funds following the earthquake have now reached around L40 billion (interview with Giuseppe Vignola, 22.5.1991). But most significantly with respect to landslides was that total spending on urban landslides (at 1988 prices) increased from L2 billion by 1978 to L15 billion by 1991.

This spending has benefitted a number of powerful interest groups in society - but its adoption has only come about as the result of the struggle behind the creation of a local discourse on landslides. In addition to 31 land-reclamation projects affecting the municipality of Grassano, appendix C details 49 projects undertaken to consolidate urban landslides. There was some spending before the current landslide crisis - in the 1930s, 1940s, and 1950s - but funding accelerated greatly after the landslides of the 1970s and 1980s. Of the total L15,258,420,000 spent at 1988 prices on landslides since the 1843, 88.1% was spent in the 1980s (figure 7.1, table 7.1, appendix C)*.

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* The figure of L13.4 billion spent on landslides in the 1980s is more than the total spent on general land reclamation programs in the municipality, also given in detail in appendix C (the exact amount spent in Grassano is difficult to judge from many of the relevant documents). What has been most important about this spending on urban landslides is that it is "extraordinary" in financial terms. It has to be competed for: this competition has a direct impact on the everyday life of the municipality, and has come to be of great political significance for the town's administrators.

Figure 7.1 Grassano: consolidation (1988 Lire)

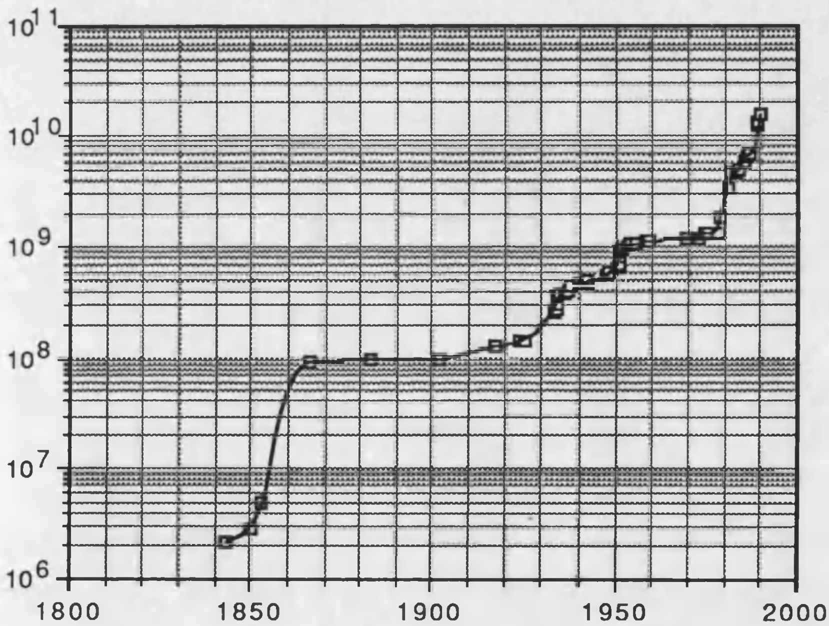


Table 7.1: Grassano: spending at 1988 prices on urban landslides from the 1840s to the 1980s (sources: appendix C)

Decade	*Projects*	*Spending (at 1988 prices)*
1840s	1	L2,200,000
1850s	2	L2,590,000
1860s	1	L88,900,000
1870s	0	-
1880s	1	L3,010,000
1890s	0	-
1900s	1	L1,900,000
1910s	1	L27,700,000
1920s	1	L20,700,000
1930s	9	L295,100,000
1940s	6	L145,220,000
1950s	10	L515,760,000
1960s	1	L18,800,000
1970s	6	L694,860,000
1980s	8	L13,441,690,000

7.3 The management of hazards

7.3.1 The political response

The environment is managed at Grassano, as elsewhere in Italy, on the basis of a compromise made between the components of the state. The right to use the power of local government in Grassano is competed for by the political parties, the main ones of which are, from left to right, the Democratic Left Party (PDS) - formerly called the Communist Party (PCI), the Socialist Party (PSI), the Social Democratic Party (PSDI), the Christian Democratic Party (DC), and the Social Movement (MSI).

The early post-war administrations were dominated by the DC, as appendix F shows. The left first achieved a majority of votes in the 1975 election. Combined, the PCI, PSI, and PSDI gained 50.1% of the vote, and ten of the twenty seats. A minority administration was set up under Luigi Daraio of the PCI. According to an interview with Nicola Vignola [1948-] the administration suffered not only from its lack of majority, but from a simple lack of preparedness to take on power. A prefectoral commissioner was brought in to run the administration between September 1975 and

August 1976, and again between February and June 1979. At the 1979 election the PCI's vote collapsed, and the DC gained an absolute majority of votes and seats.

The earthquake/landslide of 1980/1981 caused major disruption to the community, and seems to have contributed to dissatisfaction with the DC majority. The 1983 elections gave the left an absolute majority of seats once again, but no unified programme. A prefectoral commissioner was again brought in, and the elections were reheld in 1984. They produced a return to the left-right parity of 1975. Under Salvatore Incampo's leadership, the DC opened to the left, and took the PSI and PSDI into a stable coalition. The PCI and the non-party Lista Civica candidates (including Giancursio Salvatore, formerly of the MSI) were excluded from power. The Christian Democrats benefitted greatly from the political stability after 1984. They and their PSDI partners increased their seats at the expense of the PCI and the Lista Civica. After the 1989 elections, the DC-PSDI-PSI coalition continued, but the PSI's authority was reduced, and they left the coalition in 1990 to join the PCI (now renamed the PDS) in opposition.

Until the 1970s, local politicians paid relatively little attention to the problem of landslides. Tomasso Celiberti (mayor from 1952 to 1953, and 1970 to 1975) described landslides as having been "a serious problem... there were always landslides". At the Provincial level "we were considered [to have] a serious problem", but at that time other problems such as unemployment were perceived as much more important. He noted that consolidation of some sort or another was regularly carried out. There were also some minor administrative initiatives carried out: such as a ban on mining of cobbles, for building, from the gulleys around the town.

Gaetano Ambrico (mayor from 1958 to 1960) agreed that landslides had caused problems. There were some during the period of his administration, such as that at the cemetery in 1959, but he described these as minor affairs. He believed the perceived importance of landslides in the 1980s to be a result not of events acting to goad the administrators into action but of academic research.

It was only after the drama of the cemetery landslide in 1976 that there was a major change. The mayor at that time, Luigi Daraio (mayor in 1975, and from 1976 to 1979), described as "a surprise" even though he considered the cemetery area to be "prone to landslides by nature". The implications of this change are examined in section 7.3.

The councillors interviewed (Domenico Beatrice of the DC, Giuseppe Vignola of the PSI, Nicola Vignola [1948-] of the PCI, and Salvatore Giancursio of the Lista Civica) agreed that that the realization there is a landslide hazard has only recently been forced by events. Domenico Beatrice believed the landslides have always been a problem at Grassano, but that people have only responded to dramatic events - particularly the earthquake/landslide of 1980/1981. Giuseppe Vignola (then deputy-mayor) had a similar viewpoint. He believed landslides have always been a problem at Grassano but "awareness was only really aroused after the landslide of '76..." Particularly significant in this respect was, he felt, the presence of two geologists: himself, and his cousin Nicola [1948-] on the town council. Salvatore Giancursio similarly dated the realization of a crisis as coming after the 1976 landslide: "when there was this little movement at the cemetery, because before they thought nothing of it". Giuseppe's cousin Nicola Vignola [1948-] claimed that the politicians became aware of the problem only after 1980. It was principally the result of the catalyst provided by the research findings of Cotecchia, Del Prete, and Puglisi.

Since the realization that Grassano was beset by severe landslides, and devoid of adequate funds to pay for what was perceived as necessary intervention, the municipality has been forced to rely on state funds. The role of the municipality as a client for state funds has caused a great deal of resentment, and a number of speakers at Grassano's 1981 conference on soil conservation complained of the perceived lack of consultation of the local people in decision making. According to Mayor Nicola Vignola [1943-], for example, the vital decisions on the future of Grassano were taken by people outside of the community, and taken on the basis of money. "All the arguments relate to money" he said "I think the people of Grassano have the right to be allowed to understand this problem, then to choose..." (Vignola [1943-], 1981b, 114, translated).

The central government money spent on landslides has evidently been supported by much of the local electorate. Some influential locals now claim that the amount spent may be enough to ensure that future landslides do not exceed a tolerable threshold. Giuseppe Vignola of the PSI (interviewed 22.5.1991) said he believed that the money so far spent, or in the process of being spent, would ensure Grassano stability in the medium-term (decades). But stability is by no means guaranteed and calls for more money are still being made. Mayor Incampo was not quite as sure as Vignola that the situation is safe. "Perhaps more money will arrive" he suggested (interview, 23.5.1991), adding that he hoped the 1983 law on soil conservation might produce some more.

7.3.2 Local people

The participation of ordinary people in local politics is only recent. Even after the first world war, politics only involved a very small proportion of the population (with the restrictions on the franchise only about 3% of the adults voted) and was a factional context among the gentry (Camera dei Deputati, 1954; Levi, 1982; Bolettieri, 1991). It was only with the decline of the peasant society and the end of Fascism that class-based politics was established in Grassano. Local people have helped shape the development of the "local discourse" on risks and hazards through clientalism, political protest, and mass protest. For the administrators to use spending on landslides as an effective electoral ploy, the local residents would have to be convinced it is effective. Many believe it is - though agreement is far from universal as the semi-structured interviews carried out for this dissertation show (appendix G).

Question seven of the interviews showed that almost everyone at Grassano is familiar with landslides. Of the 41 who gave a reply, 20 recalled the Calvario landslide, 31 recalled the cemetery landslide, 8 recalled the Petrino landslide, and six mentioned some other local landslides. The majority believed the problem to have a physical origin, as question eight shows: 20 blamed it wholly or partially on geology, 26 on precipitation or drainage, and 3 on relief; but 4 blamed it on deforestation, 5 on lack of defences against landslides, and 1 on another cause (the supernatural).

Question nine showed that many local people were still concerned by landslides. Of the 40 who gave a reply, only 2 believed that landslides represent no hazard to the town, 12 that they represent a moderate hazard, and 26 that they represent a severe hazard. Of those who felt that there was a limited risk many believed it was limited to certain areas: Innocenzo, for example, put a figure to it: "about 20%" of the town. By contrast, to the majority the hazard was very much more serious. Domenico said "There is no stable ground." "Terrible", said Paolo, "something which never ends, and comes to the fore periodically." Giacomo described it as "terrible". Porzia claimed: "It's stupid to say there's no danger! We old ones say 'the world's finished.'"

Nevertheless, for the majority, the management programme put into effect at Grassano has had some tangible success, as question ten showed. Of the 38 who gave valid responses, 24 believed the problem was less than in the past, 6 believed it was about the same, but 8 believed it was worse. Of the majority, Pietro considered the problem had been reduced because of the surfacing work carried out on roads, and Nicolina believed the danger had abated because now it was understood (and engineering measures could be undertaken to improve it). Of those who said the problem was about the same, most believed it to be temporary, the result of a lack of rain.

Question eleven showed that of the 44 interviewed to find out their feelings about landslides, most expressed disapproval of the local authority's action. One can be characterized as believing the authority's approach to the hazard to be very good, 9 believed it to be good, 4 believed it to be adequate, but 14 considered it poor, and 8 believed it bad. Eight gave no reply or a reply of some other sort.

Question thirteen showed that many believe the government has very little interest in Grassano's problems. None can be characterized as believing the government's approach to the hazard as very good, 9 believed it to be good, 5 believed it to be adequate, but 12 believed it to be poor, and 9 believed it to be bad. Six gave no reply or a reply of some other sort. Filomena said that a road near her house, disrupted by a landslide, had remained unrepaired for five or six years (this was in 1988). "There are some shits working at the town hall... [who promise:] 'Today, tomorrow, the day after tomorrow...' There are some real shits! Will you take this to the mayor? I hope so!" *What does the government do?* "The government sends money, it arrives at the town hall and they enjoy themselves!" "But what do they do?" one of Antonio's friends added rhetorically. "Almost nothing", said another. Antonio: "We're abandoned", just like in Levi's *Christ Stopped at Eboli*, he said. Donato was more dismissive. "They don't interest themselves in anyone... they don't interest themselves in nothing", he said. *What about central government?* "Like the municipality! Worse!"

Question fourteen showed that the majority disapproved of the amount of work that was being done to prevent landslides. Eleven can be characterized as believing the work done to be adequate, 2 as believing it probably adequate, but 25 as inadequate. Six gave no reply or a reply of some other sort. Typical of those approving of the work of politicians was Innocenzo, who welcomed funds for consolidation - and for reconstruction afterwards. To eliminate the problem he considered that reforestation is necessary but "really you have to continue" with the present policies. However, Francesco said that some work's been carried out, "but not much". Central government only gives aid if it is asked. What's been done for consolidation is not enough - "Never enough!" More consolidation needs to be carried out - in the Calvario area in particular.

Question fifteen confirmed the findings of question eight that the majority at Grassano perceive the landslide hazard to have a physical origin and a technological solution. It showed that of those interviewed the majority were in favour of a technological solution to landslides - with the "active" methods usually used by the Genio Civile mentioned with greater frequency. Of the 32 interviewees who gave a reply, 9 were in favour of the use of retaining structures, and 5 of draining works; though 7 were in favour of reforestation, 2 of effective planning regulation, 5 of abandoning the town, and 8 of some other approach.

The role of grasping and advocating the complex range of demands for attention to the landslide hazard is that of the local politicians - who can be influenced by formal electoral pressure, informal clientalistic pressure, or mass protest. Clientalism has a long history at Grassano, with competition for power ensured by the factional basis of politics. Levi (1982, 34) described the situation at Grassano in the 1930s as being typical of Basilicata:

> The upper classes have not the means to live with decorum and self-respect... Small parcels of farm land do not assure them a living and, in order to survive, these misfits must dominate the peasants and secure for themselves the well-paid posts of druggist, priest, marshal of the *carabinieri*, and so on. It is, therefore, a matter of life and death to have the rule in their own hands, to hoist themselves or their relatives and friends into top jobs. This is the root of the endless struggle to obtain power and to keep it from others, a struggle which the narrowness of their surroundings, enforced idleness, and a mixture of personal and political motives render continuous and savage.

Since the last world war the limited benefits of welfarism have ensured that the struggle is less necessary and less frantic, but clientalism continues. Most people in Grassano - especially those with power - are unwilling to talk about these matters with an outsider. All the former-mayors spoke to for this dissertation denied there is corruption - save Ambrico: "of course it happens!"

Local people show a variety of responses to perceived clientalism. For Giacomo and his wife, the action of the authorities is not really relevant. Their Christian Democratic politics is dictated by religion. They acknowledged that there are dishonest people in politics, but believe they must fight for their own beliefs. Carmella was similarly disenchanted about politics at Grassano. "Worthless. Worthless because they're too indecisive to act." She had been a member of the PCI youth league, but left because of their inactivity. One of her friends said that as far as the municipal administration is concerned "the problem [of landsliding] doesn't exist". A number of people evidently were frightened about expressing their beliefs. When Angela was asked about the administration, she refused to comment because, she said, she has a son who she wants to be able to get a job in the future.

For many of the people interviewed, the programme to combat landslides was just part of a wider problem in government: that of corruption. For these people, the interests of the community are not genuinely served by the elected representatives. The representatives are principally there to serve personal interest, they claim. *What do the local authorities do?* "Nothing! Nothing really" Anna said. What works are carried out are often done shoddily and have to be redone. "In effect, the administrators here promoted the landslides." When they act "first it is for their own interests, then for the interests of others. In everything there are private interests." *But what can be done to solve the problem of landslides?* Marco said that more investment is needed, as for all the southern problems yet current investment is influenced by clientalistic influence rather than by need. "There's always the need to ask for something, and to give something in return."

Caterina claimed that clientalism is a very powerful force in Grassano politics and suggested the town's problems are "more political than geological". The report from the University of Bari (the work of Cotecchia, Del Prete, and Puglisi) gave "a pretty bad picture... most people were convinced that this proposal was made because some administators have land down there [the proposed sites for new developments]. It was the same story for the cemetery... it wasn't possible to find an area free from private interests." *Do most people think like this?* Caterina's friend added: "most... almost everyone".

Evidence for the existence of problems arising from clientalism in the town is largely anecdotal. Bolettieri (1991, 138, translated) recorded that "Every programme approved by the Cassa per il Mezzogiorno was announced in advance in a telegram by national politicians to the mayor: especially when an election was near." When this passage was read to Mayor Incampo (23.5.1991) he responded: "It's changed... above all with this recent work [begun after the Senise disaster of 1986]." Real local needs are now being satisfied, he maintained, not just the needs of politicians.

Some archival documents bear testimony to corruption, or the suspicion of it. In October 1954, a complainant wrote to the Communist newspaper *Rinascità Lucana* (letter from Salvatore Calciano, "I lettori ci scrivono", 17.10.1954, translated) claiming corruption in the building trade.

I'm asking you to give me the opportunity of denouncing one of many abuses of power that occur in this town, which is known to all as a bed of corruption.

We've got an example, one of many, which merits the telling.

...The builder X* * has blocked off two public roads, one with a dry wall the other with stakes and boards, using no-one knows what property rights. It would need a loud outcry and denunciation by the citizens to spur the clerico-liberal authorities of the municipality to intervene against X.

At the moment there has been a protest note given to the mayor and to the Genio Civile... In this protest note there are a number of clear admissions by the entrepreneur, which relate to the Genio Civile and should be investigated. The entrepreneur, in the presence of witnesses who have readily attested to the event, said that the works carried out there would be done how and when he pleased since the surveyor dined at his [X's] house...

The mayor hasn't moved, while the Genio Civile has sent a surveyor... perhaps the same who dines at X's.

Links between the building industry and the ruling Christian Democratic party are still close. For the 1988 DC festival, the Festa dell'Amicizia, ten of the twenty sponsoring firms were in the construction industry. Construction, needless to say, does not account for a half of the firms in Grassano.

Other examples show a more subtle sense of influence. In 1958 one Grassano resident wrote to congratulate the new mayor and - just in passing - to put forward his case for favourable treatment.

It was with pleasure that I heard you had come to manage the administration at Grassano, and in truth it was about time that the reins were taken over by someone with authority, who could interest himself in our town.

Among all the other problems there is that of the landslide [in the Calvario area] which affects a number of families, and me as well because my family house of about 20 rooms and some premises for [illegible] is in that area, and has remained abandoned, exposed to harm from the weather and human vandalism: because, for sure, I wouldn't disobey an evacuation ordinance.

...I have had many requests to let out the premises, but I can't accept them until I have been given permission by the relevant authorities who you could authorize to write to me again concerning my house. [AMG, Anno 1958, X, 1, 4, letter to the sindaco, dated 24.9.1958, translated.]

The request was turned down by the mayor. On the bottom of the letter he wrote in pencil (translated): "Give clarification, and news, and eventual satisfaction as merited". On September 27 the mayor replied to the letter concluding that although no immediate satisfaction was possible "I assure you, however, of my support in the

* * Name removed

matter in proceeding to the relevant organization for eventual revision". (AMG, Anno 1958, X, 1, 4, letter from the sindaco, dated 27.9.1958, translated.)

As the interviews with former-mayors indicate, interest among local politicians in the landslides at Grassano has been developing since the 1970s. Less than three years after the cemetery landslide the 1979 Christian Democrat manifesto (Democrazia Cristiana, Sezione di Grassano, unpublished, 1979, translated) indicated a readiness to tackle landslides and produced a programme to counter the hazard. Without giving further details it proposed:

> A GEOLOGICAL STUDY OF THE TOWN AND THE ENTIRE AREA, to supply the municipal administration with a way of co-ordinating the consolidation of the town and soil conservation carried out by various government organizations...
>
> THE RESOLUTION OF THE COMPLEX PROBLEMS RELATING TO THE CONSTRUCTION OF THE NEW CEMETERY AND THE CONSERVATION OF THE OLD.

After the earthquake/landslide of 1980/1981, the urgency of action and the availability of funds prompted action by local politicians. Political differences over the approach to landslides was small, mainly restricted to the stridency with which calls were made for funds and intervention.

One example was the doubts first expressed in November 1981, principally by opposition councillors, over the progress of research into the landslides (AMG, Deliberazioni del Consiglio Comunale, 1981, 307). It was not until 18 January 1982 that the research was discussed once again (AMG, Deliberazioni del Consiglio Comunale, 1982, 2, translated). Giovanni Lerose of the PCI claimed the results of the new study would be "more or less" identical to the results presented to the conference of 1981, and the only tangible difference would be the lost time. Giuseppe Vignola of the PCI said it would be the "researching in greater depth work already carried out". Lucio Manna of the MSI wanted to know why the regional government and the Genio Civile had not carried out the work earlier.

The project was not in fact approved until November 6 of that year. Once again there were complaints concerning the delays which gave members of the opposition the opportunity to criticize the majority. In a claim hotly denied by the majority, Giuseppe Vignola of the PCI alleged that delays were intentional and the administration was not competent to manage the search for a new site.

By the next election, in June 1983, there was a general awareness among politicians of the slope instability threatening Grassano. In their election manifesto, the Christian

Democrats claimed the town to be the victim of an uncontrollable "natural" disaster over which the administrators had no control - and for which they were consequently absolved of any responsibility. Yet it has a defensive tone: the party was well aware that it could (and did) suffer at the polls as a result of its handling of the crisis. "The balance of these four years of administration [by the DC] is undoubtedly positive despite the tremendous problems there have been and the extraordinary difficulties caused by the earthquake and the drainage situation." (Democrazia Cristiana, Sezione di Grassano, unpublished, 1983, translated.)

The PSI, unemcumbered by the problems of administrations was able to put its case more positively. It identified landslides as one of the major problems for the new administration. "At the centre of the administration's attention must be the three emergencies which for years have blocked development: EMPLOYMENT, SOIL CONSERVATION, and RECONSTRUCTION." (Partito Socialista Italiano, Sezione di Grassano, unpublished, 1983, translated.) The Socialists perceived the involvement of outside organizations was necessary, but warned against surrendering of local autonomy. "The municipality must... be a partner in the works carried out by the various agencies for soil conservation..." (Ibid, translated.)

In the rerun election of 1984, the perceived threat from landslides has receded further and the emphasis in political debate began to shift from consolidation against landslides to rebuilding after the damage in 1980/1981. Local autonomy in redevelopment was greater but there was a temptation for politicians to opt out of making decisions and rely on technocrats. The PSDI preferred a non-political technological "fix" to the problem, and considered it soluble through the "objectivity" of planning professionals (Partito Socialista Democratico Italiano, Sezione di Grassano, unpublished, 1984, translated).

However, the debate as a consequence concentrated less on the details of technocratic management, and more on the political issues of making strategic decisions. The Christian Democrats suggested a new version of the town plan. They recognized the locals' wish for Grassano to remain on its site, but warned that "in order to do so with adequate peace of mind it is necessary to carry out reforestation and repair works on the gulleys which surround the town" (Democrazia Cristiana, Sezione di Grassano, 1984, translated). Meanwhile, building was necessary in the expansion zones to the east of the town where there was, they claimed, "tranquility, from the geological point of view". They also proposed extending street guttering, and that new public facilities should be built including a sports centre and cemetery. The PCI, however, argued that there were more important strategic issues, over the philosophy behind preserving the town. They argued that what was needed was a programme of "organic intervention" using not just "active" methods of intervention but also "passive" methods like reforestation and planning control (Partito Communista Italiano, Sezione di Grassano, unpublished, 1984, translated).

After the Christian Democrats' victory in the election, the new variant to the town plan was authorized in October 1985. It was based on the claim that the old information was proven to be no-longer adequate:

> THE TOWN COUNCIL, given that the municipality of Grassano was classified as having had second-degree earthquake damage;
>
> realizes that it is therefore necessary to allow for the improvement of the town plan...
>
> [and] that it is indispensible to prepare a [new] geological report on the territory... [AMG, Deliberazioni del Consiglio Comunale, 1985, 400, translated.]

In March 1985, the geological report for the new plan was discussed. Nicola Vignola [1943-] of the DC reassured the council that "Engineer Viggiani, a qualified professional, could make a valid contribution to the town plan." Vignola's argument, backed by the majority, won: the council recommended unanimously to adopt Viggiani and his colleague Picarelli from the University of Naples to carry out the work. The research came up with the results required to give the approval for construction.

It is evident there was a suspicion that the process of making strategic decisions was being taken away from public debate and the council's control. Salvatore Giancursio of the Lista Civica "regretted the lack of consultation between the political groups and the technicians who were to produce the variant to the town plan". Likewise Nicola Vignola [1948-] of the PCI stressed that Viggiani held his confidence, but added that some aspects of the study "must be discussed in council".

The variant was finally passed on 5 October 1987, with twelve votes in favour and seven against (from the PCI and Lista Civica) (AMG, Deliberazioni del Consiglio Comunale, 1987, 270). The essence was explained by Bronzino in his introductory speech (ibid, "allegato 'A'", translated). "Attention has been paid to soil erosion; it is noted that Serra Martella is the only zone for further building in Grassano, that despite the needs of the citizens, it has not proved possible to use the Quarto Gradino area for geological reasons..." The opposition was extremely unhappy. Councillor Calciano denounced the plan alleging "it was not formed by the council but by the majority [DC and PSI] without any prior discussion. In addition, some of the protection against landslides present in the old plan had been eliminated in some areas." (A claim strongly rejected by Lorusso of the PSI, on behalf of the majority.) After innuendos about corruption being behind the delay, the meeting ended acrimoniously. The PCI abstained, recommending that the variant should also include planning for development. And Salvatore Giancursio dictated to the minutes: "The majority does not really have a dialogue with the opposition allowing them [the opposition] to help..." (Ibid, translated.)

The evidence on the parties' approach to consolidation and planning shows that the general strategic priorities of management are fixed on a perceived need for preventing landslides by the technological control of the land, although there may be some debate over tactical responses to it. The widespread acceptance of the need for environmental management from the far left to the far right shows the difficulty of questioning the hegemonic management ethos. This ethos has come to predominate not only because it expresses the widespread acceptance of the behaviouralist perception of hazards, but also because the dominance of these ideas became self-reinforcing. These ideas came to form the reason behind the aid-giving policies of the government, and the vote-buying business of local politics.

The archival evidence at Grassano shows that since the last world war there have been a number of occasions in Grassano when the local state, and the party machines, have been unable or unwilling to represent the wishes of all the local people over landslides. The tactical inflexibility generally exhibited by the opposition parties has meant that these eruptions of popular discontent have mainly had nothing but an ephemeral impact on the local political society - through the discontent aroused over the leftwing administrators' plan to build a new cemetery in the 1970s contributed to the significant political instability in the town.

In 1960, for example, a number of residents wrote direct to the prefect complaining about the difficulty of using Via Santo Rocco. The prefect wrote to the Genio Civile and the town hall with the request to "examine the possibility of including the requested project in the consolidation works for the town." (ASM, Provveditorato alla Opere Pubbliche, I, 177, letter from the prefetto to the Genio Civile, dated 1.6.1960, translated.)

The progress at repairing the damage from the Calvario landslide was the cause of a petition in January 1961, when 164 citizens signed the following petition: "We signatories ask when the landslide... will be cleared up, because there should be no difference between us and those who live in Piazza Santo Domenico, Via Meridionale, Piazza Arcangelo Ilvento, and in Via Capitano Pirrone and Via Serra Martella..." (AMG, file: *Frana del 1956*, petition dated 15.1.1961, translated.)

In 1974, two years before the main landslide at the cemetery, the previously-quoted twenty-five-name petition was signed complaining about damage from a landslide in the Fosso Marruggio. (AMG, Anno 1974, X, 2, 13, petition dated 21.1.1974, translated.) And in 1977, a petition from forty-three residents complained about a landslide in Vico Primo Capolegrotte (AMG, Anno 1977, X, 2, 13, letter from Domenico Villano and forty-two others to the prefetto, dated from internal evidence as July 1977, translated).

The claims of individual citizens have also been noticed - though perhaps not with the same degree of urgency. One such example was the damage from a part of the Calvario landslide which affected the property of the Rapanaro family. The damage was first notified to the Genio Civile by the mayor in 1950 (AMG, Anno 1950, X, 1, 4, letter from the sindaco to the Genio Civile, dated 4.8.1950). In 1964 Felice Rapanaro complained to the mayor about the collapse of a retaining wall.

> As you are aware, through the weakness of its foundations, the retaining wall at Largo Pontone, next to two rooms belonging to me, threatens a collapse from one moment to the next.
>
> The movement of the wall has already caused the collapse of a ground floor room and if it were destroyed the vault of that room would be as well - causing me serious financial loss. [AMG, Anno 1964, X, 2, 8, letter from Rapanaro Felice to the sindaco, dated 20.7.1964, translated.]

A letter was sent from the town hall to the Genio Civile on June 16 alerting them to the state of the wall. On July 8 the Genio Civile replied that the municipality itself had the responsibility for such emergency repairs (AMG, Anno 1964, X, 2, 8, letter from the Genio Civile to the Comune di Grassano, dated 12.11.1964).

The matter, still unresolved, was taken up again by Rapanaro at the beginning of the winter. He seems to have contacted both the Genio Civile and the town hall at about the same time. In a letter dated November 12 the Genio Civile reiterated that the local authority should carry out immediate repair works, paid for retrospectively by the government (AMG, Anno 1964, X, 2, 8, letter from the Genio Civile to the Comune di Grassano, dated 12.11.1964). Apparently crossing in the post was a letter from the mayor, dated November 14 requesting the repair of the wall to be carried out by the

Genio Civile, along with other outstanding consolidation works (AMG, Anno 1964, X, 2, 8, letter from the sindaco to the Genio Civile, dated 14.11.1960). The Prefectorate wrote to the mayor on November 24, referring to the Genio Civile's earlier letter, and asked that he "adopt with all urgency the best steps to safeguard public safety." (AMG, Anno 1964, X, 2, 8, letter from the Prefettura to the sindaco, dated 24.11.1964, translated.) The mayor capitulated and ordered minor repairs. He replied in December: "in order to prevent damage to people and to property, a fence has been erected to isolate the Largo Pontone area of this town..." (AMG, Anno 1964, X, 2, 8, letter from the sindaco to the Prefettura, dated 3.12.1964, translated.)

7.3.3 Politics and research

At Grassano, the ideological constraints of the "dominant" view of landslides as abnormal events has restricted the intellectual freedom of the town administrators just as the realities of politics have restricted their freedom of action. The various reports on the town's geology have exposed the severity of the threat to the town from landslides only slowly, as the town council was forced to concede in 1981 (AMG, Deliberazioni del Consiglio Comunale, 1981, 137). This was because a wholesale analysis of the municipality was believed unnecessary and research was carried out only when required: however, as more research has been carried out, more problems have been verified or discovered which in turn has unleashed a repressed demand for managing the land, and the allocation of more resources for even more research.

The landslides affecting the Calvario area in the 1950s led to the first postwar report on the town's geology in 1960. The municipal giunta originally asked the geologist Vincenzo Cotecchia of Bari to carry out a study of landslides (AMG, Deliberazioni della Giunta Municipale, 1960, 26) but it was eventually undertaken by the municipal surveyor, Michele de Cuzzi (ASM, Provveditorato alle Opere Pubbliche, I, 177, "Relazione tecnica dell'abitato di Grassano"). The report noted the steep slopes of the town, the nature of the geology, the problem of floodwater and gave opinions on necessary works to consolidate against landslides. The problem was considered relatively minor and the report suggested that the landslide hazard could effectively be overcome by reducing the infiltration of water into the subsoil - particularly the repair of water and sewage pipes, and the surfacing of roads. De Cuzzi's estimate of the money required to eliminate (in entirety) the problem: only L160 million [*L1.9 billion*], was very much lower than the later estimates.

The writing of a town plan made the next report necessary. Town plans, which have by law to include a geological report, were first made compulsory for small towns like Grassano in 1967 (Mengoli, 1982; King, 1987). It is forbidden by law to allow the development of land that is or may be subject to landsliding, or to put others at risk from landslides or avalanches (Alexander, 1987).

In his report for the first town plan Boenzi (unpublished, 1973) recorded a number of deep slump landslides quoted in section 5.1.1.1. But he was well aware of the necessary limitations of the study, and suggested more detailed research if and when the areas were to be developed. The full plan recognized that landslides were potentially of great danger to the town, limiting as they did the town's expansion. Il Politecnico (unpublished, 1973, 125-126, translated) urged that "the citizens must in a very real way come to regard consolidation as a collective good..." It suggested expansion of the town, assuming a stable population of 8,000 by 1983 (it was in fact 6,157) and a demand for higher standards of accommodation. Most of the new accommodation (63%) was to be built in the expansion zone east of the town, deemed to be less vulnerable to landslides.

The relative lack of information on landslides at Grassano is not unusual, because the threat posed by landslides to towns in Italy was not well documented until the 1970s (Alexander, 1987). Although 25% of municipalities replying to a National Order of Geologists' survey in the 1970s had been affected by landslides, only 5% had instigated research into local geology. In 1975, following new funds from the government, the Basilicata region ordered research to be carried out in Grassano - though at some future, unspecified date. It was only after the cemetery landslide of 1976 that serious attention began to be paid to the problem of the slope instability affecting the town.

The cemetery was not relocated as Boenzi (unpublished, 1973) had recommended it should be - and the 1976 landslide caused significant damage. The immediate result was a panicked attempt to find a site for the proposed new cemetery. It was planned to have a minimum area of 1.7 ha, plus 0.9 ha of gardens. As a result of its size, a geological study into its location was a legal obligation (Bonelli, Bianchi, and Brandi, unpublished, 1977). Rapisaldi and the Vignola cousins (Rapisaldi, Vignola, and Vignola, unpublished, 1977) suggested that the site should be close to the east of the town, relatively even, relatively stable, and well drained. As section 7.3.4 shows, a site to satisfy these criteria has not yet been found, principally for political reasons.

By 1980 the DC administration was already planning further research into soil conservation throughout the municipality, according to its earlier election promises. Mayor Vignola wrote to the President of the Regional Giunta of Basilicata requesting L50 million [*L111 million*] funding for a research project (UTMG, letter from the sindaco to Vincenzo Verrastro, dated 3.3.1980). The situation, as it was then understood, was made plain at a special sitting of the town council in August 1980 which noted that the extreme impact of the Calvario and Cemetery landslides on the town and condemned past inaction. The deliberation which was produced amounts to a damning criticism of past policies (perhaps a criticism that owes a little to neophytic zeal) and called for research into the town's geology (to inform intervention by government agencies and co-ordinate their consolidation works) as well as funding "commensurate to the dramatic nature of the situation" (AMG, Deliberazioni del Consiglio Comunale, 1980, 305, translated).

> THE town council of Grassano, urged by explicit requests from groups of councillors, political parties, mass organizations and unions, and becoming aware of the urgent necessity of soil conservation and the consolidation of the town, approves unanimously the following order of the day...
>
> BECAUSE the municipality of Grassano, and more precisely the urban area, is composed of easibly-erodible fragile rocks it is affected by continuous landslides. Relevant to this can be cited two examples which sufficiently clarify the degradation of the physical environment of Grassano: the landslide of winter 1956 which caused the destruction of two districts of the town, and that of autumn 1976 which affected the cemetery and condemned it to complete destruction;
>
> DISCOVERING that in both cases almost nothing was done to contain the mass movements and nothing to prevent them. Neither can the timid attempts at reforestation and the sporadic public works carried out be said to be satisfactory because of the lack of money and short-lived nature of the projects involved... [Ibid, translated.]

The earthquake/landslide of 1980/1981 and the research which followed it confirmed the fears that a large part of Grassano could be vulnerable to landslides. As early as 15 December 1981 the council decided "to consolidate stability is paramount in any discussion of reconstruction", and to carry out "a full intervention for... the consolidation of the town" (AMG, Deliberazioni del Consiglio Comunale, 1980, 314, translated). It became evident that the problems which landslides posed for Grassano were enormous. They were spelt out by the then-mayor Nicola Vignola [1943-] in his address which opened the conference on soil conservation in 1981.

> Drainage problems have stopped and are hindering the completion of important public works, programmes, projects and finance for this municipality. For example: the construction of the new cemetery, development in the artizan area, construction of new reservoirs for increasing the water supplies, the construction of the new sports complex, construction of the new water

> purification plant, the construction of the Mulino provincial road, and the "Petrullo", "Acquasalsa", and "Tilea" local roads. [Vignola [1943-], 1981, 1, translated.]

It was immediately recognized that even with heavy expenditure there was always the chance that the damage would be repeated. Del Prete (unpublished, 1981) considered that the cost of intervening at Grassano would be in the order of L10 billion [*L18.8 billion*] after which there would be a 25 to 30% risk of the project failing to be adequate. Asked his opinion on whether the town's reconstruction would worsen the effects of the landslide, Del Prete replied that consolidation of the landslide would be possible. He proposed: either the demolition of the town, which would be "inadvisable" for social reasons (ibid, 20, translated), or the control of sub-surface water for which "conditions are not easy" (ibid, translated), or to improve surface drainage.

According to Gaetano Ambrico (interview) the case for transference of the town had first been made by Zanotti-Bianco before the War; and subsequently by Cotecchia and others. At the conference Grieco argued: "...even these problems of transference should be looked in a new way because it is not true that there are habits and traditions which tie people to their 'own' area. Today what counts is a new quality of life, which drives man [sic] to migrate... it is a new and different type of civilization which the individual wishes to enjoy." (Grieco, 1981, 101, translated.) But when the people of Grassano were offered the opportunity to support the relocation of their town, at an exhibition organized by Giuseppe Vignola and Nicola Vignola [1948-] their reaction was an almost-unanimous rejection (interviews). It is evident that any planned transference of the town would be very unpopular with voters - and consequently almost certainly impossible for any party to carry out.

In March 1981 the council reiterated its call for a co-ordinated programme of consolidation (AMG, Deliberazioni del Consiglio Comunale, 1981, 136, translated). It decided to call for L10 billion for consolidation against landslides, and to leave the decision of whether to relocate the town to the comfortable future, after further research. Its deliberation read as follows:

> HAVING NOTED that up until now nothing has been done, neither to forsee problems nor to control landslides when they are occurring...
>
> [The council] DENOUNCES Once more the awful situation of the municipality which has been severely hit by the above-mentioned natural events...
>
> AND ASKS [the national and regional authorities]:
> to assign ten billion lire in the way suggested by Professors Cotecchia, Del Prete, and Puglisi of the University of Bari who described to the conference the urgent works necessary for the consolidation of the town - to give back a minimum level of security to the worried population

for further successive finances to ensure:
a valid and secure consolidation which excludes the possibility of any risk in the future;
research for the choice of alternative areas suitable for the development of Grassano outside the present town, for use if necessary in the future;
revision of the town plan.

AND HOPES that in the law on the reconstruction of the earthquake-hit area, huge finances will be made available for the problems of soil conservation and soil erosion. [AMG, Deliberazioni del Consiglio Comunale, 1981, 137, translated.]

Three reports were produced on the geomorphology of Grassano by the research team of Cotecchia, Del Prete, and Puglisi. In the first of their reports (Cotecchia, Del Prete, and Puglisi, unpublished, 1981) they came to the conclusion that the problem at Grassano was going to cost between L15 billion and L16 billion [*L28.3 billion to L30 billion*] of consolidation was needed. Even given this spending, they warned that the risk to the town would still be between 25 and 30% - though the estimate was based on the theory that the paleoslide is sufficiently vulnerable to slip given a seismic shock, an assumption questioned by Radina and Vignola (1981). Cotecchia, Del Prete and Puglisi pointed out that the alternative to consolidation was full or partial transference of the town south to the Basento valley, or northwest to Bivio Calle (Cotecchia, Del Prete, and Puglisi, unpublished, 1981).

The final research report by the same team (Cotecchia and Del Prete, unpublished, 1983) looked at the potential for development for the variant on the town plan. To the east of the town they found reasonable stability, but recommended that the new reservoir should be kept away from landslide scars. In the town centre, drainage, reforestation, and forestation was proposed.

After the election of 1984 the research by Cotecchia, Del Prete, and Puglisi - with its unpopular emphasis on transfering the town - did not form the basis of the new variant of the town plan. They had looked, Engineer Dichio said (personal communication), at too long a timescale, "a geologist's timescale" - rather than the civil engineer's timescale of 200 years or so. Why should the people [or, more to the point, the administrators] of Grassano be worried about what happened after that, given the enormous changes over the past two centuries? he asked.

New research was carried out by a team from the University of Naples: Picarelli and Viggiani. And it came up with the results required to give the go-ahead for construction. Picarelli and Viggiani did not share the views of Cotecchia, Del Prete, and Puglisi on the paleoslide, describing it as "a hypothesis only, which is a long way from being proved." (Picarelli and Viggiani, unpublished, 1986b, 44, translated.) For the town centre they proposed the channelling of drainage water, the repair of the water and sewage network, control of the gulleys to the south of the town, and the improvement of foundations in the town centre (unpublished, 1986d).

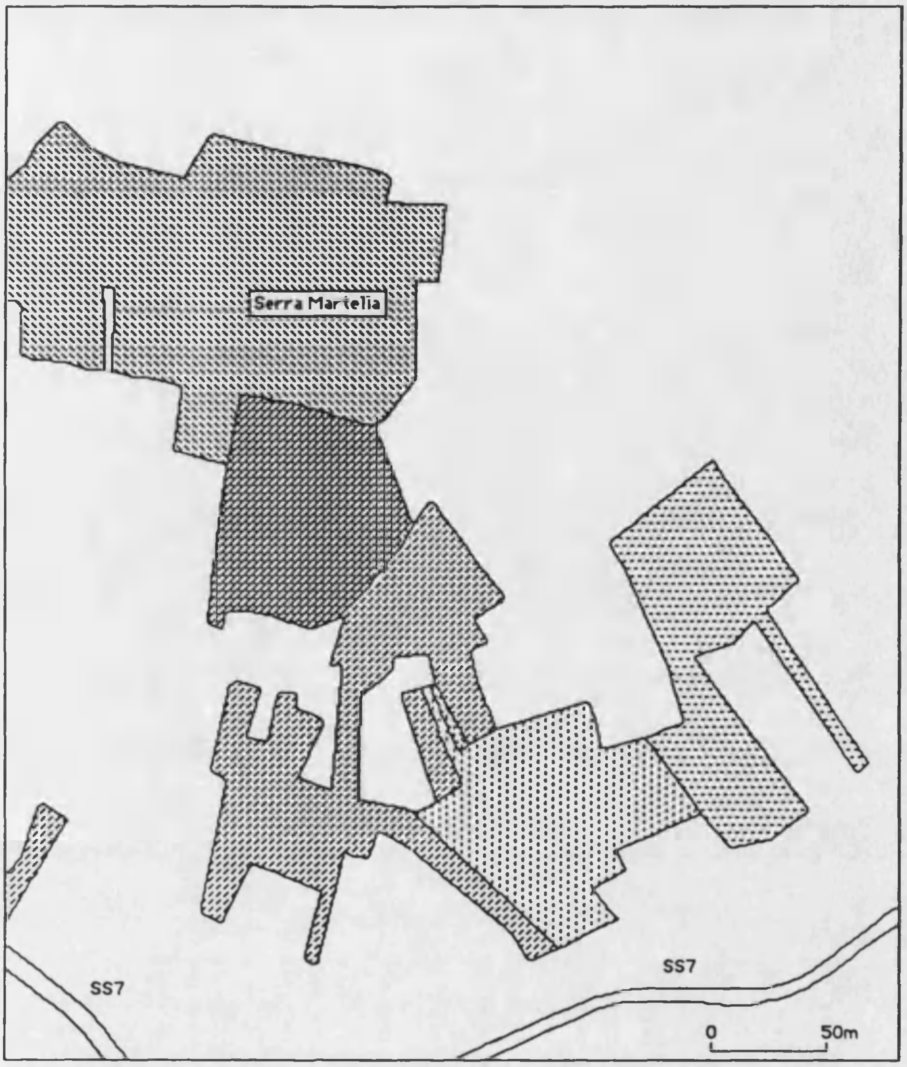
Money is now available to make, at the very least, a significant contribution to reducing the landslide hazard at Grassano. It is evident from the preceding discussion that the reaction to landslides has reflected a local discourse on hazards, with the research undertaken influenced by the need the administrators perceive to provide a solution to landslides from within the current political system. Nowhere is the influence of the practical considerations of the local discourse on hazards more evident than in the case of the cemetery.

7.3.4 The cemetery problem

The landslide at the cemetery in 1976 provoked a crisis of government at Grassano. The solution to the problem shows the workings of the management of landslides: limited as it was by the weakness of local government, and influenced by clientalism, political conflict, popular protest, and the subsequent discovery of highly-unpalatable information on the landslide.

The damage was so severe that it was originally assumed a new cemetery would be necessary - as had been envisaged in the town plan. The plots of land to be used for the new cemetery were those on the catasto map 13, numbers 601, 606, 607, 623-629, 727, 728, 813, 914, and 915 (figure 7.2). Initial hopes were not, however, based on the real nature of political life at Grassano. The Communist administration had severe difficulties in coming to terms with the power that it held for the first time. In the ensuing crisis the hoped-for became the impossible.

It was claimed that the proposed new site for the cemetery would be "more stable and more suitable from the geological point of view than the old one", according to the



Plots 601 606-7 623-9 727-8 813 914-5 } overlap
Plots 567 601 652 649

Plots 538 549 569-71 583-5 587-91 593 599-601 622 725-6 783 811-2 1494 } overlap
Plots 425-35 437-48 450 496 536 539 711-2 822 1397 1398

Figure 7.2 Grassano: land plots around the site of the new cemetery (source: from UTMG)

obligatory report produced by the Provincial Commission for Cemeteries (AMG, file: *Nuovo Cimitero*, "Verbale di sopralluogo della Commissione Provinciale per i Cimiteri", dated 1.12.1976, translated). Yet when the commission eventually made its obligatory inspection of what was claimed to be the new site, it was apparently taken to other plots. According to a later claim by Francesco Carbone on behalf of the Grassano branch of the Associazione Italiana Coltivatori (AMG, file: *Nuovo Cimitero*, "Osservazioni alla Variante di P.R.G. del Comune di Grassano", dated 2.11,1977) the commission was taken to plots 601, 576, 652, and 649 - of which only 601 had been in the original plan for the new cemetery area. Unaware of the difference the Committee gave the necessary permission for the cemetery to be built - given that there would be further exploratory research because of reservations over the water table underneath the site.

The reasons for this surprising change appears to have been to accommodate the political realities at Grassano. On December 9 Mayor Daraio had written to the owners of a number of plots inviting them to meet to discuss the appropriation of their land, as recommended by the Cemetery Commission. At their meeting on December 14 it proved impossible to gain complete assent from the gathering, and it became evident that a new site would be politically necessary. The sensitive nature of local politics at the time meant that bad feeling over dispossessed owners would have been a very serious threat to the administration.

In an interview (16.8.1988), Daraio claimed that the site he had proposed was "more or less" that in the town plan but claimed that "interested people" suggested that the area was not precisely that proposed in the plan. He said the site had in fact been chosen by the municipal surveyors, who indicated one particular area which had a slope about the same as the original site. The majority of proprietors were amenable but others (all Christian Democrat supporters, he claimed) caused trouble. In the file on the new cemetery in the archives at Grassano there is a map of the new site. The old proposed site is marked in in red biro. Around it is a series of appears to be new sites pencilled in, the prospective new sites were rotations of the old, indicating that they were devised by whoever drew them to avoid the land of selected landholders (AMG, File: *Nuovo Cimitero*, rough sketch apparently of possible new sites for the cemetery). Twenty-four plots were tentatively suggested: 538, 549, 569-571, 583-585, 587-591, 593, 599-601, 622, 725, 726, 783, 811, 812, and 1494 (ibid).

By December 18 when the council met to debate the cemetery, matters were still in a state of flux. The council deliberation on the site (AMG, Deliberazioni del Consiglio

Comunale, 1976, 204, translated) explained: "THE Provincial Cemetery Commission expressed a favourable decision on the said area, located 200 m from the zone of [urban] expansion specified in the town plan. A good proportion of the affected proprietors have agreed with the decision, while others are opposed to it... the area chosen is that [also] chosen for geological reasons in the town plan." The site was not greeted with overwhelming enthusiasm by councillors. Councillors Giancursio, Carbone, and Nicola Vignola [1943-] all complained that the site was too close to the town, and could restrict the area available for new housing. When the meeting was reconvened the following day, Daraio stated that the area eventually to be chosen "had to be specified with respect to the town plan" (ibid, translated) which the council agreed unanimously.

On 24 February 1977 research was commissioned into the site of the proposed new cemetery, following the insistence of the Provincial Cemetery Commission. The work was undertaken by Professor Rapisardi, with the aid of the two Vignola cousins, Nicola [1948-] and Giuseppe. They rejected the old site (Rapisardi, Vignola, and Vignola, unpublished, 1977), noting that the water table would be at a locally variable depth, which without piezometric analysis it would be impossible to determine), and considered the site part of an area with only "precarious stability" (translated). The new area chosen, again on sheet 13 of the catasto map, was plots 425-435, 437-448, 450, 496, 536, 538, 539, 711, 712, 822, 1397, and 1398. Bonelli, Bianchi, and Bandi (1977, 6, translated) later commented on this proposal that: "The area within the perimeter has an irregular form, it is most unusual compared to the traditional cemeteries in our area, characterized almost always by square or rectangular plans." This unusual compromise was in the interest of the proprietor of the land on which it was planned to build the cemetery. Rapisardi's report on the new location for the cemetery was adopted by the council (AMG, Deliberazioni del Consiglio Comunale, 1978, 9). The proposals received the necessary ratification from the Genio Civile in December 1977, and were formally accepted by the council on 14 March 1988.

The original site was rejected for practical political reasons - and a compromise site had to be found. The explanation given for the changes in the site had been agreed upon was that there had been no specified original site. It was now claimed that Boenzi (1973) had merely suggested a "general site to the EAST of the town and north of the SS7" (AMG, Deliberazioni del Consiglio Comunale, 1978, 9). Almost as if the debates over the site had never taken place.

When the Communist administration fell a prefectoral commissioner was appointed to run the town. Among the documents that came to the attention of the commissioner were those relating to the new cemetery's site - including complaints that alleged irregularities in the procedure for choosing the site which had been lodged by three locals. These documents had previously been rejected by the council as irrelevancies (AMG, Deliberazioni del Consiglio Comunale, 1978, 9). The commissioner passed the matter over to the prefect, realizing the site proposed by Rapisardi had in fact never been given the necessary consent of the Cemeteries Commission. The prefect reconvened the Cemeteries Commission in March 1979: and on the 29th the Commission carried out an inspection of Rapisardi's recommended site. Its findings were that the new area identified for the cemetery was not suitable for geological reasons. They found:

> that the said new area is nearby that previously proposed;
>
> that the area proposed can, geologically, be subdivided into two zones;
>
> the first identified in yellow on the plan attached to the geological report, which is suitable;
>
> the remainder does not have the right requirements being in an area affected by landslides.
>
> ...the area proposed [as a whole] therefore does not satisfy legal requirements... [AMG, file: *Nuovo Cimitero*, "Verbale di sopralluogo della Commissione Prov.le per i cimiteri per parere preventativo localizzazione area per costruzione nuovo cimitero in Grassano", dated 6.4.1979, translated]

In May the commissioner revoked Council Deliberation 127 of 1977, which had accepted the Rapisardi report (AMG, Deliberazioni del Consiglio Comunale, 1979, 84). It did not prove possible to break the ensuing deadlock until after the earthquake/landslide of 1980/1981 which threw matters at Grassano into a new state of confusion. In 1982 Mayor Nicola Vignola [1943-] claimed the town and its territory was "stricken by serious geological problems..." and requested a prolongation of the deadline for a project "in order to allow the detailed geological study" (AMG, file: *Nuovo Cimitero*, letter from the sindaco to the Provveditorato alle Opere Pubbliche, dated 8.2.1982, translated).

The requested project was at that time being undertaken by Cotecchia, Del Prete, and Puglisi who eventually concluded that the proposed new location of the cemetery was too close to the urban area, and that a nearby new site would be difficult to find - for geological reasons (Cotecchia, Del Prete, and Puglisi, unpublished, 1983). They proposed that the site should be on the north side of the Serra Martella, rather than on the south side which had previously been attempted. The new area they proposed was on an old landslide deposit 13 metres thick and "appearing to have been stable for a long time" (ibid, 26, translated). But they warned that the erosion evident along the length of the Strettolone road north of the site could lead to deteriorating stability in the future. A second alternative was proposed at Masseria Franceshiello: a site of around 40 ha, some 3 km to the south of the town.

The findings were rejected by the municipal administration as the basis for a new plan. When Picarelli and Viggiani (unpublished, 1986c) examined Rapisardi's proposed site they concluded that the area is part of a paleoslide - but the morphology is devoid of "elements which would indicate a moving landslide" (ibid, 11, translated). The stability of the area would be compromised by the presence of a water table, or by seismic shock; although drainage would increase it.

The need originally perceived for the new cemetery was stifled for several years, and the crisis generated by the landslide of 21 November 1976 consequently remains unresolved. In part, perhaps, this can be seen as a failure - a failure of the scientists to argue their case and a failure of the bureaucrats to act. In May 1991 the council agreed to a new site to the east of the Serra Martella - though members of opposition parties have suggested that the plan will prove too expensive ever to be realized (interviews).

The example of the cemetery landslide shows the extremely complex processes determining the local discourse on hazards. The outcome of this discourse has been to preserve the existing approach to hazards: for the very practical reasons outlined, the response to the damage caused to the cemetery in 1976 was subordinated to factional-political and party-political issues. The result enshrined these considerations as politically legitimate practical considerations to be taken into account in managing the landslides hazard. This happened because the options for radical change - even with the leadership of the PCI/PDS - were so limited, and the hegemony of the technocratic approach to landslides so complete.

7.4 Conclusions

This chapter examined why the scale of the response to landslides at Grassano has increased so significantly during the twentieth century - and what the impact has been of this changing response on the reaction to the landslides. It showed that the real increase in landslides, combined with a greater modern sensitivity to hazards in general, has generated a concern which has had a profound effect on political life at Grassano.

For the reasons already discussed, there has been a real increase in landslides in Basilicata during the twentieth century - also experienced at Grassano. In combination with the greater sensitivity of modern society to hazards and the associated determination of government to control it this has led to a significant increase in the bureaucratic effort spent on landslides. More effort and more funds has meant an increase in the reporting of problems, and combined with the greater dissemination and survival of these reports this has led to a greatly increased volume of information on landslides.

The concern over landslides has stimulated research projects and public debate over the management of the land. Although evidence has begun to appear that suggests that the current approach to the land is highly inappropriate, it has continued. This is because the local discourse on landslides from which that approach follows has, until now, acted to reinforce existing power relationships. Landslides have proved helpful for the political and bureaucratic elite because landslides mean money. The very exercising of political power which these funds allow reinforces the legitimacy of the power of the spenders, and the faith which stems from this legitimacy is such that revolutionary change in the approach to the environment is still stifled. The small likelihood of this process being slowed or reversed is of fundamental importance to the future of Grassano, and the many settlements like it in Basilicata. It will be discussed in the next chapter.

Chapter 8: Summary and conclusions

This chapter summarizes the dissertation's findings, relates them to the dissertation's thesis, and examines the extent to which the thesis has been examined. The chapter then draws conclusions on the general nature of environmental hazards and their specific operation in the dissertation's case study. It then concludes with an evaluation of the dissertation, the directions it implies for future research, and the general significance of its findings.

8.1 Introduction

This dissertation has examined humankind's impact on the intensity of environmental hazards, exemplified by landslides in Basilicata. The research has shown that in Basilicata the intensity of landsliding has been significantly increased as a result of a longstanding inability by humankind to control the undesired effects that arise from a destructive approach to the land. This inability is the product of exploitative social and political structures which have been manifested in an inappropriate treatment of the physical environment (notably through farming and associated deforestation, but increasingly by urbanization). The approach to the land which has arisen under capitalism makes it a more destructive type of socioeconomic system than any that have gone before.

8.2 Summary of work done

The aims of the dissertation were introduced in the preface to chapter one, section 1.1, and its objectives in the introduction, section 1.2. Sections 1.3.1 and 1.3.2 showed how environmental hazards are an important and very expensive indicator of humankind's vulnerability to environmental fluctuation. Landslides cause a significant, though underestimated damage worldwide, but are especially threatening in the Mediterranean region - and particularly well documented in Italy, as section 1.3.3 explained. Basilicata, and the municipality of Grassano, were chosen for study because of contacts available there, and the wealth of the background literature and documents available on the region's environment. The section shows that the landslide hazard in the region is sufficiently intense that its analysis is both of academic worth and significant practical importance.

The choice of case study is also justified for firm methodological reasons: as was explained in section 1.4 this dissertation combined a structuralist ontology and a realist epistemology, which indicated the need for a methodology that would combine regional (extensive) research with local (intensive) analysis. Section 1.5 showed in outline how this was to be done in the context of Basilicata, and the information the dissertation needed to establish in order to make a significant contribution to knowledge. Extensive research showed the intensity of the past and present regional patterns of landslides (chapter three), and the dynamic interaction of the physical and social factors which have accounted for them (chapter four). Intensive analysis showed the physical and social factors which have accounted for past and present patterns of landslides at Grassano (chapter five), the pattern of landslides which they have caused (chapter six), and the factors which have increased modern sensitivity and determined the modern reaction to landslides (chapter seven).

The literature on environmental hazards, of which landslides are an example, was discussed in chapter two. Section 2.1 showed the concept of "nature" to be an ideological construction based on humankind's alienation from the land. The significance and the complexity of this relationship is acknowledged in the dissertation's rejection of the term "natural hazards", and its adoption of "environmental hazards" to describe the threats posed to humankind by the environment. Section 2.2 discussed the different approaches to the environment, that explain contrasting approaches to hazards research.

Section 2.3 showed that to the environmental determinists hazards were an unavoidable constraint on humankind, though recent research is more sanguine on the point of avoidability. Behaviouralist hazards research, based on the human ecology perspective, suggests that human involvement in the modification of the environment may worsen hazards but it can also mitigate their worst effects. The structuralist critique of hazards has suggested, however, that social organization is an important contributor to hazards, and that a more rational social organization could consequently help reduce them.

The implications of these approaches to hazards for the analysis of landslides was analyzed in section 2.4. Landslides are physical processes, but the environments and the contingent circumstances in which they occur are frequently influenced by humankind. In the Mediterranean the influence of humankind is a particularly important consideration because it has been so intense and so prolonged. The ability of hazards theory to account for these complex causes was the subject of the remainder of the section. Behaviouralist research has tended to concentrate on the geophysical triggers of landslides in order to help their prediction and suppression through the application of technology; but structuralist research has looked for deeper causes and has indicated that landslides are inextricably linked with the societies that they affect, that technology can only be a (partial) remedy, and that a real cure can only come through fundamental social change.

The dissertation's research question was discussed in section 2.5. It was designed to examine the critical difference between the behaviouralist and structuralist approaches on the extent of the influence of humankind and physical factors on environmental hazards with reference to the evidence in Basilicata. The research question, designed to allow this examination and to produce an argued analysis of landslides in the region that would be informed by the theoretical background, was: *how has humankind increased the intensity of the hazard from landslides in Basilicata, and why has that increase been caused?*

Chapter three examined the intensity and distribution of landslides in Basilicata. Based on a number of sources, section 3.1 showed landslides are very common, affecting almost all parts of the region, and 81% of its towns (including Grassano). Section 3.2 examined the historical evidence on urban landslides in the region which indicates that the reported damage from landslides has increased over recent centuries - and have noticeably worsened since 1900.

Chapter four assessed the importance of the physical and environmental factors behind the increase in reported landslides in Basilicata. Section 4.1 emphasized the complexity of attributing the causes of landslides there. Section 4.2 showed why the region is, by nature of its physical environment, highly susceptible to slope instability and has a high "normal" level of landslides - notably in the uplands of the Bradano Trough. Basilicata has a predominantly steep relief; a geology which exhibits fragile lithological types, degraded soils, and many weaknesses of geological structure; intense tectonic and neotectonic activity with an associated seismicity; and a mediterranean climate characterized by summer drought and winter rain. This generally vulnerable environment has been extensively modified by human activity over several thousand years. The section concluded that the influence of humankind on the physical environment of the region is so important that physical factors cannot be discussed adequately in isolation from the societies with which they have evolved.

Section 4.3 showed the ways in which the region's physical environment has been subjected to an significant indirect and direct modification by humankind. Most of these modifications have tended to decrease slope stability: deforestation has been extensive, and was particularly rapid during the nineteenth century; agriculture has been required to support a population which has increased significantly in size; and the marginalization of the peasantry - which began before the introduction of capitalist agriculture but was greatly accelerated by it - caused increased farming pressures, particularly on the most vulnerable land; recent urban development associated with industrialization has accentuated land degradation. Set against these generally destructive changes the section explained the attempts over the past century and more to reclaim land and prevent landslides, but showed why it has been limited in its effectiveness by poor, often-corrupt administration, and the application of technology that has often been inappropriate.

The town of Grassano was introduced in chapter five. It provides an example with which to examine the material presented in chapter three on the causal relationships behind the regional pattern of landslides - which indicated an increase in reported landslides during the twentieth century. Section 5.1 gives an introduction to the town and its surroundings. It is one of those many reported in chapter three in which reported landsliding has worsened during the twentieth century, and is affected by a number of urban landslides that are a serious hazard. Most notable in this respect is the paleoslide that underlies the town centre and which appears to have moved after severe seismic shocks: individual units have moved repeatedly during the twentieth century.

Section 5.2 showed that, like much of Basilicata, Grassano is highly susceptible to landslides because of the nature of its physical environment, and has a high "normal" level of landslides. The town is particularly vulnerable because it is located on a steeply-sloping hillside; has a vulnerable lithology formed of conglomerate, clay, sandstone, and chaotic landslide deposits; has been subjected to a number of severe earthquakes this century - notably in 1930 and 1980; its climate is semiarid; and only vestiges of the climax vegetation remain.

The feudal farming regime that was relatively benign in environmental terms was followed by an increasingly intense use of the land after the introduction of agricultural capitalism. According to the evidence presented in section 5.3, the site of Grassano has probably not been occupied for more than a thousand years, but during that time its inhabitants have caused significant change in the surrounding land. By the end of the nineteenth century there had already been extensive deforestation, and a continuing pressure on the land through agricultural development has followed. The rapid expansion of the town's built-up area during the late twentieth century has been on to land which has a moderate susceptibility to landslides; but a combination of construction work with growing water consumption and associated drainage, has caused a significant increase in erosion and gulleying. The chapter concluded, in section 5.4, that social and physical factors operate together to modify the land and that the landslides affecting the town are contingent on short-term combinations of triggering factors.

Chapter six showed that the factors discussed in chapter five, which have caused such significant environmental change in the municipality of Grassano, have led to a real increase in the level of landsliding. The historical evidence presented in section 6.2 showed that Grassano experienced extensive environmental degradation before the twentieth century, which caused widespread drainage problems and a number of landslides. Section 6.3 described the history of landslides at Grassano. It described early landslides in Via Cinti, Via San Sofia, and in a number of other locations - though none were particularly significant. The evidence in sections 6.3.4 and 6.3.5 showed how, particularly since the 1950s, Grassano has been affected by two severe landslides: in the Calvario district and at the Cemetery. There was earlier evidence that these areas were unstable, but the Calvario landslide of 1956 and the Cemetery landslide of 1976 were unprecedented in the damage that they caused. Even though the fear these events aroused was greatly enhanced by the contemporary discourse on landslides, and by the twentieth century there was already a problem of urban landslides at Grassano, but the hazard was relatively less intense than it was to become later in the century.

Chapter seven analyzed the factors behind the increased fear of landsliding during the twentieth century and the increased attention that has been paid to them. In section 7.1 it analyzed the concept that within society there is a discourse on landslides that has determined the perception and treatment of them. Section 7.2 acknowledged that although landslides have increased in intensity in Grassano, the greater attention paid to them is in part because of greater modern sensitivity to environmental hazards. The section showed how the central government responded from the late 1970s onwards to the reported increase in the hazard from landslides with a very rapid increase in the funds available for consolidation throughout Basilicata.

Section 7.3 showed that the combination of an intensifying hazard and a greater sensitivity to it have combined to produce a concern over landslides that has its origin in the local discourse on hazards. The state has been forced to respond to this concern and has attempted to control it - but without success. State intervention has actually worsened the perceived problem because more money has encouraged more research... which has uncovered more problems. Support for the policies subsequently pursued has been ensured by the machine nature of local and national politics.

Before the 1970s landslides were generally ignored as a serious threat to the town because they were perceived as essentially insoluble and unpredictably irregular in occurrence: but from the 1970s the experience of serious landslides, combined with the detailed research on the town's geology which began in 1981, greatly increased awareness of the town's vulnerability to the hazard: and at the same time the money which began to become available for consolidation gave the potential for at least reducing that vulnerability. The section explained how the political system, directed to the satisfaction of clients, was galvanized by the new money available. Accepting the central government funds meant accepting political indebtedness to central government, but it allowed dramatic political gestures which, though of doubtful effectiveness in terms of insuring against slope instability, were undoubtedly successful in maintaining credibility for the ruling parties and the bureaucracy they employ. The difficulties which arise from the political manipulation of landsliding is demonstrated by the example of the inability to solve the problems which have arisen from the partial destruction of the town's cemetery in 1976.

Section 7.4 gave the chapter's conclusions on the current approach to landslides - that despite rapid environmental changes, the conservative nature of the discourse on hazards has ensured that the current response to landslides should continue. So strong is the hegemony of this discourse that the political opposition is unable to question the ruling parties' approach to the town's environmental problems, and merely works to suggest more efficient ways of pursuing present policies. This is despite the fact that the policies carried out to ameliorate landslides act to benefit the political status quo and reinforce it.

8.3 Evaluation of work done and statement of limitations

8.3.1 The work done and its limitations

The dissertation showed through its analysis of landslides in Basilicata why environmental hazards are of real academic and practical concern. The case-study approach taken to do this is inevitably a compromise between workability and explanatory validity, but compromise need not be harmful provided it is acknowledged, and forms part of a coherent strategy to a desired end. The coherence of the chosen approach was ensured by a strict adherence to the guiding principles of an internally-consistent methodology (based on realism). The use of any methodology both restricts and empowers the research, but realism was chosen because it provided the significant advantage of a robust methodological framework within which to explore the physical and social factors involved in environmental change, their contingent local operation, and the hazards they produce.

The critique presented in chapter two shows that none of the approaches to environmental hazards is entirely satisfactory, but the dissertation took a broadly structuralist methodology for its analysis. This approach was vindicated because the material from Basilicata shows the importance of considering the nature of society as an important structural factor determining the intensity of landslides - but only in the context of the physical environment which society can modify considerably. However, until now, most structuralist research on hazards has avoided taking environmental constraints into account as a significant factor in the contingent nature of hazards.

The complexity of empirical material in Basilicata showed the importance of an approach which acknowledges the dynamic relationship between the physical environment and society. The changes in the regional pattern of landslides implicitly support the contention that humankind has had considerable influence over the increase in their intensity. Although the environment of Basilicata is by nature vulnerable to landslides, it is because there had been no significant endogenous change in the environment of the region that the dynamic social changes (which have consistently been associated with rapid environmental change) can be inferred with reasonable security to be responsible for the increase in landsliding.

The evidence on Grassano is limited by being from one locality only: but, as the discussion in chapter two shows, this need not hinder research. Grassano was chosen, very much in the geographical tradition, as an example with which to examine contingent conditions - though this could only be done because the regional context was already understood. It confirms the regional pattern of social change inseperably linked to environmental change. It shows that these links were geographically specific because they depended on local circumstances, and were specific to the locality. At Grassano the landslides have worsened this century: and any analysis why must take into account the very complex interaction between the physical and social structuring factors identified at the regional level.

The history was explained but a number of important questions remained to be answered, through the detailed study of the town, on what lay behind it:

• What combination of factors accounted for the increase in reported landslides there?

• Was the pattern of landslides reported a real one or just a perceived one?

• If it was at least in part a real increase did concern over landslides grow, and has this affected the approach to the hazard?

Evidence on the landslides at Grassano was mainly limited to the urban area. However, this was not necessarily a drawback - because it allowed a detailed examination of the locally specific factors in the area where the physical environment has been most intensively influenced by society. Whether society is essentially passive or potentially active in its relationships to hazards is a fundamental difference between the behaviouralist and the structuralist approaches: and the urban landslides at Grassano give the clearest possible evidence of the active influence of humankind on the land.

8.3.2 Further research

There is good deal of the further research which could be carried out on the subject matter for this dissertation, as is made implicit by the questions generated by the preceding discussion. Indeed, the fragmentary nature of much of the evidence uncovered demands more research to fill the gaps in knowledge. The research required can be divided into the analysis of the general approach to hazards which informs this dissertation, and the specific subject matter - though these two categories are not mutually exclusive.

Basilicata has been taken as emblematic of the landslide hazard which exists elsewhere in the Mediterranean. More empirical data would obviously help to increase the understanding of the processes which occurred, and consequently the relevance to other areas of those patterns which have affected Basilicata. More material would also help to test the relevance of the specific case material dealt with in this dissertation and to expand the confidence with which its results could be applied elsewhere. Particularly helpful in this respect would be more research on places with similar problems to Grassano, and a number of those towns discussed in chapter three would be suitable (perhaps, given importance of formal politics in determining the local discourse on hazards, those with a different political history such as Irsina and Calciano). Although, as the dissertation has shown, a great deal of research has been carried out into the geomorphology of the landslides in and around Grassano, this dissertation has generated more topics for geomorphological research - particularly the application of dating techniques to give detail to the historical events described.

Much more work could be carried out into the general question of the links between social change and environmental hazards. This dissertation has explored the importance of the environment in structuralist research: it has demonstrated the importance of considering environmental constraints alongside politics and economics. It has introduced those constraints explicitly into political-ecology research on environmental hazards - but has explored only one example of its occurrence. A number of questions on the structure/agency nature of this relationship could be answered by a more detailed analysis of specific topics in the dissertation. This is particularly important if the results discovered are to inform work carried out on other places and on other times. Most notably: how independent of society do environmental processes remain? and which structuring factors are important in influencing the contingent nature of hazards in other places?

Additional research could help to put the evolution of a humanized environment in a general context of social history. More relevant in direct terms to this dissertation is that it could help to put the research in a more comprehensive and readily-relevant context: and by doing so, allow the empirical data and analysis to be more understood, used, and useful. In particular, it could help to indicate more clearly the social structures which prevent the effective reduction of hazards such as landsliding, and by showing them provide the theoretical basis for practical action to change them.

8.4 Contribution to knowledge

This dissertation unavoidably has imperfections in its design, material, and findings: but has provided a number of very useful insights into the material studied and the broader questions which that material illustrates. It has made a number of theoretical and empirical contributions to knowledge - though these two categories should not be understood by the recognition of that conventional divide to be mutually exclusive. The contributions have been: providing a critique of existing theory, uncovering new information, and providing a synthesis of the existing information with the new information necessary to answer the dissertation's research question.

Any complete analysis of landslides must draw on both the behaviouralist approach to hazards and the structuralist approach. Like any set of coherent ideas, these two approaches both empower research (by making the world coherent through their contribution to knowledge and understanding) but also restrict it (by the inevitable, partial misrepresentations of reality which they include). As chapter two shows, representatives of both schools have acknowledged the incomplete explanations which they give. The material presented in this dissertation demonstrates the need for a different approach.

The material discussed in this dissertation has shown that both approaches to hazards come close to explaining what occurs - but neither comes quite close enough. The behaviouralist approach denies the qualitative difference between humankind and other species in its acceptance of "human ecology" - and with it denies the ability to "cause" processes that contribute to hazards. The structuralist approach accepts that humankind has a role in causing hazards, but fails to recognize explicitly that this is mainly an indirect cause which modifies the physical factors that structure the contingent nature of hazards.

The contribution of this dissertation to the theory of hazards is consequently one of tone... It asserts that importance must be given to both the social and environmental causes of hazards, but stresses that these forces can no longer be discussed in isolation from each other. In this respect it allows an updating of the political-ecology approach to hazards based on the methodological changes in geography in the 1980s. In specific terms it has shown the importance of political and economic factors in structuring the behaviour of society to the environment, and the significance of the environment in structuring the form and nature of the hazards which affect societies.

The empirical part of this dissertation has provided significant new information on the historical increase in the intensity of landslides across Basilicata, which it has put in the context of the available secondary sources. The comparison between published sources on landslides with new archival evidence demonstrated for the first time the changes affecting landslides this century. This pattern in turn conforms to the available evidence on erosion rates, and shows high erosion rates to have been a reasonable proxy for the levels of land degradation and landslides. Its establishment of the links in Basilicata between humankind and landslides substantiates the secondary texts indicating an increase in degradation over the past several millenia. Much of the information it contains is made available for the first time in English.

Of particular importance is the specific information on Grassano, put in context by the broader patterns of regional change. The material on Grassano explained the contingent operation of the causal mechanisms behind the broader patterns, and the availability of a wider context in which to place the case study ensured a fuller understanding of the processes behind the regional pattern. This work provided a detailed environmental history of Grassano, taken from a variety of sources - almost none of which had been previously available, and demonstrated the validity of the modified political-ecology approach used for explaining environmental degradation.

The dissertation has shown that in Basilicata the intensity of landslides has been significantly increased as a result of humankind's inability to control the unforseen consequences of its destructive approach to the land, and that this destruction has been particularly intense since the introduction of capitalism. Capitalism, and the social structures which support it, has been the most important factor in the current increase in urban landslides, but it has not been the only factor - which calls into question the validity of the political ecologists' assumption of a "natural economy" in which the peasantry is in equilibrium with the environment. The dissertation has shown humankind's relationship with the environment to be a dynamic one: all societies have caused environmental change, though the damage in the past was less because the rate of exploitation of individuals (and consequently of the land) was lower.

8.5 Discussion of the significance of the results and their application

Contemporary society has shown itself to be increasingly sensitive to hazards and increasingly intolerant of them. This general trend away from riskiness causes a desperate desire for a solution to landsliding, that continues unsatisfied because humankind can never be liberated from the environment. Indeed, humankind is irrevocably a part of the environment, and cannot stand outside it.

The very large amounts of money spent on consolidation against landsliding in Basilicata are treating the problem, but they cannot cure it. This is because the projects used are guided by the same social interests which helped to produce the current problem. Since they reinforce the legitimacy of the powerful, these factors reproduce and strengthen those interests when they are put into effect. The restriction of the intervention measures against landslides to mainly tactical measures ensures that landsliding will continue to be a serious hazard in Basilicata until current social and economic relationships are changed, and that the failure of opposition to these measures means the approach to landslides will reproduce the power relationships which created them.

If the desire of freedom from landslides cannot be satisfied it can at least be assuaged. This dissertation has aimed to be descriptive rather than prescriptive. It has not attempted to dictate solutions, but to indicate how successful different approaches to providing solutions could be. This is a deliberate choice because change can only come about through a fusion of theory and practice - which can only occur in Basilicata itself through the practise of participants in the political process, rather than by outsiders.

The options available for change are limited by the region's physical and social structure. This dissertation has shown that real change in the relationship between humankind and the environment will be very difficult to achieve because it would entail a fundamental disruption of the exploitative political and economic structures which in the past have promoted both the action that has intensified environmental changes, and the social inertia that prevents those practices from being stopped. It is evident that, given the strength of existing vested interests in society, the genuine social change which is necessary for a real solution will probably be a long time coming even given the current political changes in Italy.

How a real solution could be created is not easy to forsee. An interesting perspective was given by Sandbach's (1984) identification of three discrete approaches to environmental change, based on the ideologies of conservatism, liberalism, and socialism. Each approach could provide a "solution" which is not optimal, but satisfactory to its own ideological imperatives. The conservative approach is based on the assumption that environmental crisis is unavoidable, and the only effective response to the social tensions which crisis will bring is their suppression by authoritarianism. The liberal approach is for the continued improvement of technology to allow society to evade the worst consequences of environmental crisis. And the socialist approach is for the reduction of perceived social inefficiency to prevent it at source.

In the Italian context, the conservative solution is not impossible. Indeed, twentieth-century political history has repeatedly demonstrated the vulnerability of the Italian political system to authoritarianism at times of crisis. A totalitarian solution would not necessarily preclude a rigourous technological response to landslides (it did not preclude it during the Fascist period) but political repression would delay, perhaps indefinitely, the fundamental social changes which this dissertation has shown to be necessary for a lasting solution to landsliding.

The liberal, technocratic solution has been the approach to landslides adopted since the last war. It seems likely to continue for the forseeable future as the hegemonic approach to landslides. Yet as this dissertation has shown, technology is not a full solution to the problem of landsliding - although it can reduce the harm suffered it will not entirely prevent landslides, and cannot prevent the fear which they cause.

The only solution to a society based either on fear of authority (as is conservatism) or fear of the environment (as is liberalism) is a socialist society, which might eliminate, or at least reduce, the conflict between humankind and the environment. The establishment of such a society would involve the immensely difficult problem of a radical change to the contemporary theory and practice of environmental relations. Overthrown would have to be the cultural prejudice for the division between humankind and external nature: if ever completed this would allow the end to the attempt to conquer external nature, because external nature would become an anachronistic concept. Also overthrown would have to be the cultural prejudice for the supremacy of internal nature: society would be fully humanized, fully responsible for its own actions and able to take responsibility for its impact on the environment.

The implementation of a such a society would require not just an economistic solution, but also an environmentalist solution. Economistic socialism has been shown by experience to be capable of reducing class antagonisms - but not environmental antagonisms (it may begin the abolition of the concept of internal nature, but cannot begin the abolition of the concept of external nature); while western environmentalism may begin the abolition of the concept of external nature, but it cannot begin the abolition of the concept of internal nature.

Even if an environmental-socialist solution to landslides in Basilicata would be the optimal one, it would not be without its problems. It would be forced to recognize that because of the physical constraints which will continue, a new "balance of tolerance" would have to be established in which landslides would once again come to be recognized as "normal", "everyday" events. This would possibly make it necessary for society to recognize that the problem arising from many landslides (perhaps including those at Grassano) may only be soluble by the acceptance that some landslides will always be unavoidable, and that in a number of cases this may even make necessary the abandonment of towns.

Appendix A: The landslide-inventory maps

The gridcells used in the landslide-inventory maps are numbered as in figure A.1. They run from west to east and south to north. The percentage of each gridcell covered by erosion is followed with the percentage covered by landslides; the location of the 131 municipalities is given in brackets after the data for the gridcells in which they lay.

Gridcells 001-006: 18/1, 10/2, 10/0, 0/0, 17/1, 1/10.

Gridcells 007-018: 0/1, 20/3, 21/0 (Rotonda), 6/0, 11/0, 5/0, 13/0, 7/6, 20/4, 15/7, 30/0, 18/0.

Gridcells 019-031: 0/2 (Maratea), 0/1, 0/11, 14/0, 40/2 (Vigianello), 37/3, 8/0, 24/2, 8/6, 54/0, 18/7, 11/0 (Terranova di Pollino), 42/0.

Gridcells 032-053: 0/0, 0/3, 0/10, 0/31 (Trecchina), 2/15, 3/14, 0/0, 8/0, 14/0, 5/0 (Casteluccio Inferiore, Casteluccio Superiore), 3/0, 0/0, 4/0, 22/0, 16/0, 46/0, 22/0, 16/0 (San Severino Lucano), 46/0, 29/0, 92/0, 60/3, 36/2, 68/0, 58/1.

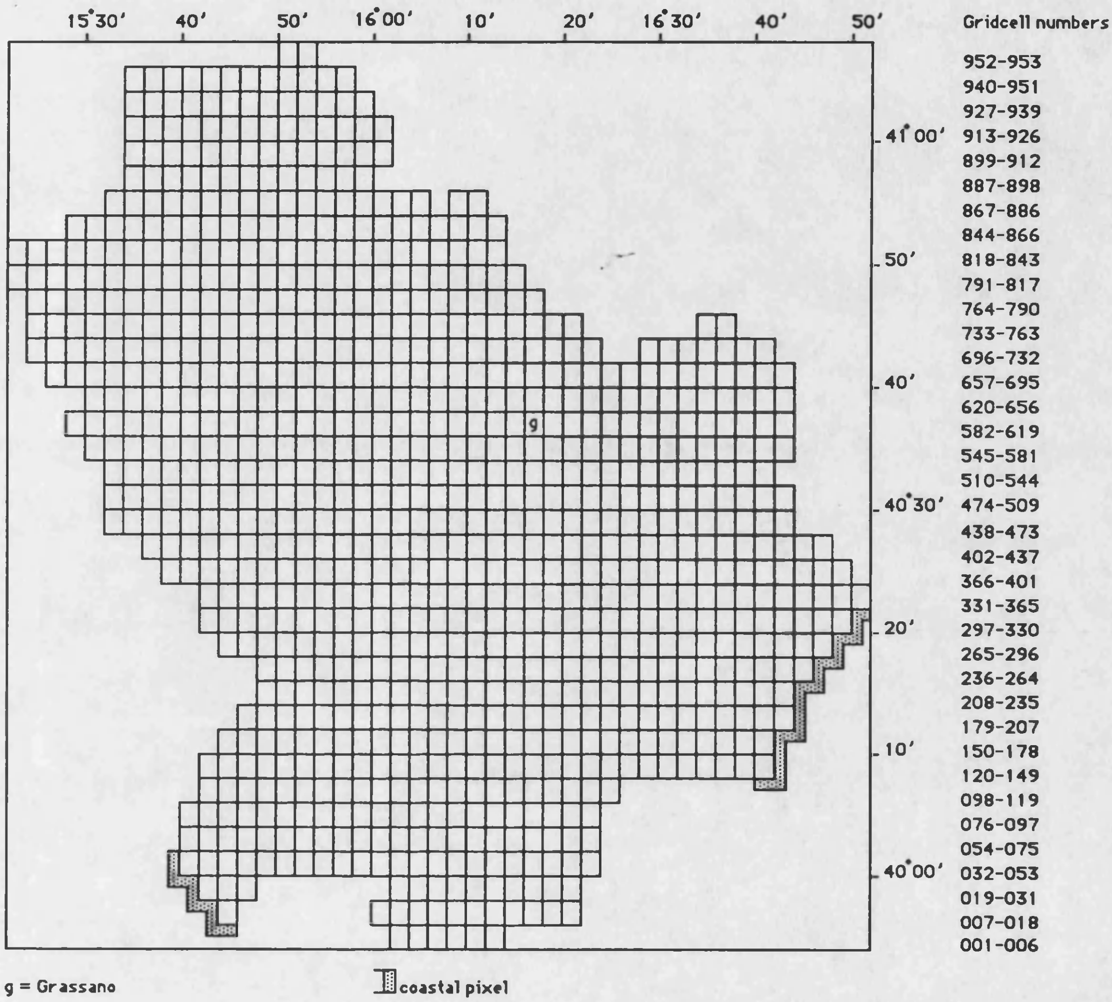
Gridcells 054-075: 0/4, 0/0, 0/6, 0/35, 2/33 (Nemoli), 1/26 (Lauria), 3/10, 12/16, 20/5, 0/0, 1/0, 5/0, 10/0, 15/0, 3/0, 23/0, 52/5, 57/1, 12/0, 35/2 (San Constantino Albanese), 64/0 (Cersosimo, San Paulo Albanese), 33/10.

Gridcells 076-097: 0/1, 0/0, 1/33 (Rivello), 3/27, 0/7, 1/4, 0/24, 4/38, 6/21, 8/0, 6/0 (Latronico), 19/0, 28/0 (Episcopia), 38/0, 43/0, 10/2, 30/0 (Francavilla in Sinni), 31/0, 15/0, 50/1 (Noepoli), 48/0, 70/0.

Gridcells 098-119: 2/0, 2/6 (Lagonegro), 9/4, 0/0, 1/0, 26/4, 9/26, 14/33, 12/0, 9/0, 7/0, 16/0, 13/0, 28/0 (Teana), 30/1 (Fardella), 20/0 (Chiaromonte), 11/0, 15/0, 33/0, 74/0, 24/0, 36/0 (San Giorgio Lucano).

Gridcells 120-149: 0/0, 4/34, 1/2, 22/1, 15/0, 15/0, 20/7, 17/5, 15/3 (Castelsaraceno), 20/0, 5/0, 16/0 (Carbone), 10/0, 19/1 (Calvera), 11/0, 15/0,

Figure A.1 Basilicata: outline of landslide-inventory maps



13/1, 22/1 (Senise), 48/0, 70/0, 59/0, 32/1, 38/0 (Valsinni), 3/0, 9/4, 8/0 (Nova Siri), 24/0, 4/0, 1/0, 0/0.

Gridcells 150-178: 0/3, 2/16, 4/2, 4/1, 3/5, 3/0, 0/0, 3/1, 2/2, 28/2, 6/1 (San Chirico Raparo), 5/0, 34/0, 50/3 (Castronuovo di Sant'Andrea), 65/0, 84/0, 98/0, 94/0, 23/0, 28/2, 10/0 (Colobraro), 9/5, 7/5, 13/10 (Rotondella), 10/0, 4/0, 2/0, 0/0, 0/0.

Gridcells 197-207: 5/19, 9/1, 0/0, 6/0, 3/0, 1/0, 6/0, 12/2, 26/6, 15/0, 35/0, 40/0, 34/0, 25/1 (Roccanova), 40/0, 87/0, 90/0, 12/0, 8/0, 14/2, 18/0, 9/1, 3/0, 8/0, 2/0, 2/0, 1/0, 0/0 (Policoro), 0/0.

Gridcells 208-235: 4/0, 3/0, 0/0 (Moliterno, Sarconi), 2/0, 0/0, 8/1, 9/0, 11/0 (San Martino d'Agri), 17/0, 12/0, 16/0, 5/0, 17/0, 18/0, 50/0 (Sant'Arcangelo), 85/0, 20/2, 8/0, 25/0, 34/2, 7/1 (Tursi), 30/0, 17/0, 4/0, 0/0, 1/0, 0/0 (Scanzano Jonico), 0/0.

Gridcells 236-264: 0/0, 0/0, 3/0 (Grumento Nova), 3/0, 0/0, 19/0 (Montemurro, Spinoso), 6/0, 14/0, 17/0, 16/0, 37/7 (Galicchio), 34/0 (Missanello), 33/0, 50/0, 83/0, 20/0, 27/0, 21/0, 22/1, 13/2, 3/0, 8/0, 19/1 (Montalbano Jonico), 10/0, 2/0, 3/0, 0/0, 0/0, 0/0.

Gridcells 265-296: 1/1, 0/0 (Tramutola), 0/0, 0/0, 0/0, 0/1, 3/13, 6/0, 2/0, 14/1 (Armento), 8/0, 19/1, 17/0, 14/3, 18/1 (Aliano), 81/0, 97/0, 73/0, 40/3, 43/2, 32/0, 20/0, 24/0, 11/0, 13/0, 8/0, 6/0, 1/0, 0/0, 0/0, 0/0, 0/0.

Gridcells 297-330:0/0, 2/0, 0/0, 0/0, 0/0, 2/3, 3/16 (Viggiano), 1/21, 2/0, 8/4, 7/3, 19/0 (Guardia Perticara), 20/0, 37/0, 10/2, 29/0, 19/0, 2/0, 18/0, 23/0, 24/0, 19/0, 39/2, 54/0, 32/0, 11/0, 18/0, 20/0, 15/0, 17/0, 0/0, 0/0, 1/0, 0/0.

Gridcells 331-365: 1/0 (Paterno), 0/0, 2/1, 0/7 (Marsico Novo), 9/10, 2/32, 1/32, 3/25, 2/1, 11/0, 6/1 (Corleto Perticara), 20/0, 34/0, 5/1 (Gorgoglione), 9/2 (Cirigliano), 33/1, 22/2, 13/0, 10/0, 20/0, 15/0, 4/1, 13/2 (Craco), 35/0, 18/0, 48/0 (Pisticci), 18/0, 32/0, 17/0, 18/0, 0/0, 3/0, 0/0, 0/0, 0/0.

Gridcells 366-401: 8/16, 1/1, 0/0, 1/3 (Marsicovetere), 0/0, 0/0, 10/33, 4/50, 0/44, 9/25, 11/2, 9/0, 8/2, 13/0, 5/2, 4/6, 16/2, 17/5 (Stigliano), 18/2, 8/6, 27/0, 27/1, 36/0, 29/0, 48/0, 56/0, 44/0, 9/0, 10/0, 38/0, 41/0, 24/0 (Bernalda), 0/0, 3/0, 0/0, 2/0.

Gridcells 402-437: 7/0, 15/0, 4/0, 3/33, 3/21, 1/1, 6/2, 8/20, 6/37, 1/67, 8/62, 28/0 (Laurenzana), 21/0, 7/5, 13/2, 4/1, 15/7, 16/7, 10/3, 13/1, 17/12, 22/3, 26/1, 26/0, 56/0, 40/0, 69/0, 24/0, 55/0, 54/0, 61/0, 45/0, 17/0, 0/0, 0/0, 0/0.

Gridcells 438-473: 2/0, 0/0, 0/5 (Brienza), 2/1, 2/10 (Sasso di Castalda), 9/5, 0/0, 2/11, 11/30, 3/12 (Calvello), 8/0, 9/11, 1/3, 24/0, 10/0, 16/1, 2/7, 14/2, 42/2 (Accettura), 17/2, 23/17, 13/2 (San Mauro Forte), 10/24, 34/0, 65/3, 53/0, 56/0, 46/2 (Ferrandina), 28/0, 33/0, 49/0, 67/0, 38/0, 42/0, 33/0, 3/0.

Gridcells 474-509: 19/3, 17/0, 4/11, 3/2, 7/0, 9/0, 5/0, 25/0, 5/0 (Abriola), 4/4, 16/2, 15/1 (Anzi), 9/2, 3/8, 3/0, 4/2 (Castelmezzano, Pietrapertosa), 13/3, 5/0, 3/4, 3/2 (Oliveto Lucano), 0/10, 1/3, 2/7, 49/0 (Salandra), 40/0, 23/2, 19/7, 15/18, 29/0, 29/3, 26/4 (Pomarico), 33/0, 0/0, 2/0, 0/0, 3/0.

Gridcells 510-544: 26/3 (Sant'Angelo le Fratte), 10/1, 2/8, 3/1 (Satriano di Lucania), 0/0, 0/5, 2/0, 0/1, 1/0, 2/0, 0/0, 8/1, 56/0, 17/5, 10/0, 5/0, 11/1 (Campomaggiore), 0/7, 0/1, 1/8, 6/9 (Garaguso), 4/8, 10/0, 17/5, 0/4, 11/8, 16/2, 38/0, 16/1, 2/8, 21/3, 9/0, 0/0, 16/0, 20/0 (Montescaglioso).

Gridcells 545-581: 34/1 (Vietri di Potenza), 13/2 (Savoia di Lucania), 19/0, 5/5, 0/3, 0/2 (Tito), 8/0, 4/10 (Pignola), 20/5, 0/6, 3/0, 24/12, 27/2, 12/1 (Trivigno), 4/1, 13/5 (Albano di Lucania), 17/10, 2/3, 2/6, 5/9 (Calciano), 48/18, 12/2, 11/0, 7/2, 31/1, 25/3 (Grottole), 32/7, 20/4, 18/2, 15/1 (Grottole), 5/0, 2/0, 1/0, 13/0 (Miglionico), 4/0, 2/0.

Gridcells 582-619: 10/3, 1/4, 12/0, 29/0, 3/2, 3/3, 0/14, 31/8, 2/5, 0/6, 5/6, 13/5, 7/10, 8/16, 21/7 (Brindisi di Montagna), 44/4, 15/4, 8/1, 6/0, 2/0, 9/5 (Tricarico), 12/9, 7/0, 15/1, 13/2 (Grassano), 11/0, 4/0, 12/0, 10/0, 16/0, 12/0, 12/0, 7/0, 2/0, 5/0, 14/0, 0/0, 0/0, 0/0.

Gridcells 620-656: 12/0 (Balvano), 18/0, 25/0, 1/6, 17/32 (Picerno), 1/40, 11/6, 14/5, 0/8, 7/0 (Potenza), 7/2, 17/1, 13/2 (Vaglio Basilicata), 38/0, 14/3, 19/3, 6/0, 4/5, 7/4, 13/6, 6/1, 3/0, 4/0, 2/2, 2/0, 11/0, 8/0, 11/0, 3/0, 1/0, 2/0, 0/0, 5/0, 0/0 (Matera), 0/0, 0/0, 0/0.

Gridcells 657-695: 0/0, 0/0, 0/0, 3/3, 2/0 (Baragiano), 2/0, 3/0, 4/0, 6/0, 10/2, 8/0, 3/1, 12/4, 21/11, 11/8, 11/30, 19/25, 9/12 (Tolve), 4/33, 4/59 (San Chirico Nuovo), 9/14, 0/3, 11/0, 0/0, 2/0, 6/0, 10/1, 13/1, 7/3, 0/0, 0/0, 4/0, 0/0, 0/0, 0/0, 0/0.

Gridcells 696-732: 1/0, 1/0, 6/0, 0/0, 10/0, 15/2, 6/0, 4/0, 21/3 (Ruoti), 25/1 (Avigliano), 13/11, 9/0, 7/3, 9/2, 10/6, 44/6 (Cancellara), 19/15, 10/19, 5/20, 20/19, 9/18, 1/1, 9/0, 0/1, 10/0, 20/0, 1/0, 0/0, 0/0, 0/0, 0/1, 2/1, 1/1, 0/0, 0/0, 0/0, 0/0.

Gridcells 733-763: 0/0, 2/0, 0/0 (Muro Lucano), 14/0, 31/1 (Bella), 9/0, 22/6, 16/0, 34/2, 25/8, 4/3, 3/0, 2/0, 5/2, 4/2 (Pietragalla), 0/1, 10/17, 7/47 (Oppido Lucano), 22/12, 4/0, 8/0, 10/0, 11/0, 28/0, 4/0, 0/1 (Irsina), 5/1, 3/0, 10/0, 0/0, 0/0.

Gridcells 764-790: 0/0 (Castelgrande), 6/1, 11/2, 13/2, 17/3, 16/3, 5/1, 22/2, 2/12, 8/6, 15/0, 1/0, 1/1, 12/4, 7/2, 1/0, 9/20 (Accerenza), 5/47, 21/5, 2/0, 3/0, 3/0, 7/0, 4/0, 0/0, 0/0, 6/0.

Gridcells 791-817: 11/6, 1/11, 21/1, 37/1, 13/0, 22/0 (San Fele), 18/0, 6/3, 13/2, 3/4, 2/0 (Filiano), 3/1, 5/6, 0/0, 0/1, 1/0, 11/3, 27/7, 20/4, 9/12, 4/12, 2/0, 1/0, 0/0, 8/3, 1/2, 0/1.

Pixel 818-843: 5/0 (Pescopagano), 10/0, 11/6, 16/0, 11/0 (Rapone), 21/0 (Ruvo del Monte), 11/2, 0/0, 8/1, 0/0, 1/0, 5/5, 1/0, 5/1, 1/0, 5/5, 7/3 (Forenza), 5/1, 15/0, 9/0, 1/5, 0/1 (Banzi), 0/5 (Genzano di Lucania), 36/0, 22/0, 4/0, 1/0, 0/4.

Gridcells 844-866: 3/1, 12/0, 0/1, 0/0, 1/0, 0/0 (Atella), 3/0, 8/2, 0/1, 0/0, 4/4, 17/2, 0/0, 6/0, 8/0, 0/0, 0/0, 4/0, 15/2, 15/0, 0/3, 0/0, 0/4.

Gridcells 867-885: 8/0, 11/0, 3/0, 0/0, 7/0 (Rionero in Vulture), 1/0 (Ripacandida), 0/1, 6/2 (Ginestra), 3/0 (Maschito), 8/0, 1/0, 0/0, 1/0, 0/0 (Palazzo San Gervasio), 0/0, 1/0, 0/0, 2/4, 0/0.

Gridcells 886-898: 5/0, 2/0, 0/0, 2/0 (Barile), 9/3, 22/1, 3/0, 0/1 (Venosa), 0/0, 14/0, 10/0, 3/0, 0/0.

Gridcells 899-912: 12/1, 0/0, 1/0 (Melfi), 5/1 (Rapolla), 4/1, 2/0, 9/0, 0/0, 5/0, 11/0, 13/0, 0/0, 1/0, 0/0.

Gridcells 913-926: 7/12, 6/4, 12/6, 23/1, 1/7, 1/0, 0/0, 0/0, 0/0, 0/0, 0/0, 4/0, 2/0 (Montemilone), 1/1.

Gridcells 927-939: 43/0, 9/0, 6/0, 2/0, 0/0, 0/0, 0/0 (Lavello), 0/0, 0/0, 0/0, 0/0, 2/0, 2/1.

Gridcells 940-951: 8/0, 0/0, 0/0, 0/0, 0/0, 0/0, 0/0, 0/0, 0/0, 0/0, 0/0, 2/0.

Gridcells 952-953: 0/0, 0/0.

Appendix B: The regional landslide data

B.1 The historical data

This appendix gives the data for the regional historical comparison of landslides made in chapter three. Although there are problems with their selectivity and (often) their reliability, historical sources can be very important for research into environmental change, as Hooke and Kain (1982), Hansen (1984b), and Fanthou and Kayser (1990) noted. They may be the only sources of information, they allow the absolute dating of events, and they can allow comparisons of change to be made.

Published sources dealing with the historical development of landslides in Basilicata are limited, though information on the area can be gleaned from a number of statistical, written, and graphical sources dealt with in this dissertation. The most helpful archives were the state archives of Matera, Potenza, and Naples. The Archivio del Municipio (municipal archives) of Grassano provided a very large amount of information from 1938 onwards (earlier documents had mostly been damaged or destroyed). A number of offices gave relevant up-to-date information: the Ufficio Tecnico del Municipio at Grassano, the Ufficio Erediale of Matera, and the Ufficio Tecnico of ANAS (Potenza). A number of other sources provided supplementary information: the Archivio della Chiesa Madre di Grassano, the Archivio del Prefettorato di Matera, the Archivio Vescovile di Tricarico, and the Biblioteca Comunale di Grassano.

B.2 Chi-square tests

The following is a chi-square analysis of the historical data given in table 3.3 of the text.

B.2.1 Contingency comparison of 1906 to 1910

Summary statistics: degrees of freedom = 2, total chi-square = 13.237, probability of null hypothesis = 0.0013

Observed frequency table:

1906 code	*1*	*2*	*Totals*
1910 code			
1	29	17	46
2	8	14	22
3	11	32	43
Totals	48	63	111

Expected frequency table:

1906 code	*1*	*2*	*Totals*
1910 code			
1	19.89	26.11	46
2	9.51	12.49	22
3	18.59	24.41	43
Totals	48	63	111

B.2.2 Contingency comparison of 1906 to 1986

Summary statistics: degrees of freedom = 4, total chi-square = 10.746, probability of null hypothesis = 0.0296

Observed frequency table:

1906 code	*1*	*2*	*Totals*
1986 code			
1	13	7	20
2	10	6	16
3	17	24	41
4	8	24	32
5	1	2	3
Totals	49	63	112

Expected frequency table:

1906 code	*1*	*2*	*Totals*
1986 code			
1	8.75	11.25	20
2	7	9	16
3	17.94	23.06	41
4	14	18	32
5	1.31	1.69	3
Totals	49	63	112

B.2.3 Contingency comparison of 1910 to 1986

Summary statistics: degrees of freedom = 8, total chi-square = 16.199, probability of null hypothesis = 0.0396

Observed frequency table:

1910 code	*1*	*2*	*3*	*Totals*
1986 code				
1	15	6	3	24
2	10	1	6	17
3	21	9	18	48
4	10	7	20	37
5	0	1	2	3
Totals	56	24	49	129

Expected frequency table:

1910 code	*1*	*2*	*3*	*Totals*
1986 code				
1	10.42	4.47	9.12	24
2	7.38	3.16	6.46	17
3	20.84	8.93	18.23	48
4	16.06	6.88	14.05	37
5	1.3	0.56	1.14	3
Totals	56	24	49	129

Appendix C: Spending on landslides

C.1 Introduction

The historical data on extraordinary-spending projects designed to consolidate against the urban landslides of Grassano is discussed in chapter seven. Spending on landslides is difficult to determine, and the figures given can only be considered an approximate guide to what has been done, for several reasons:

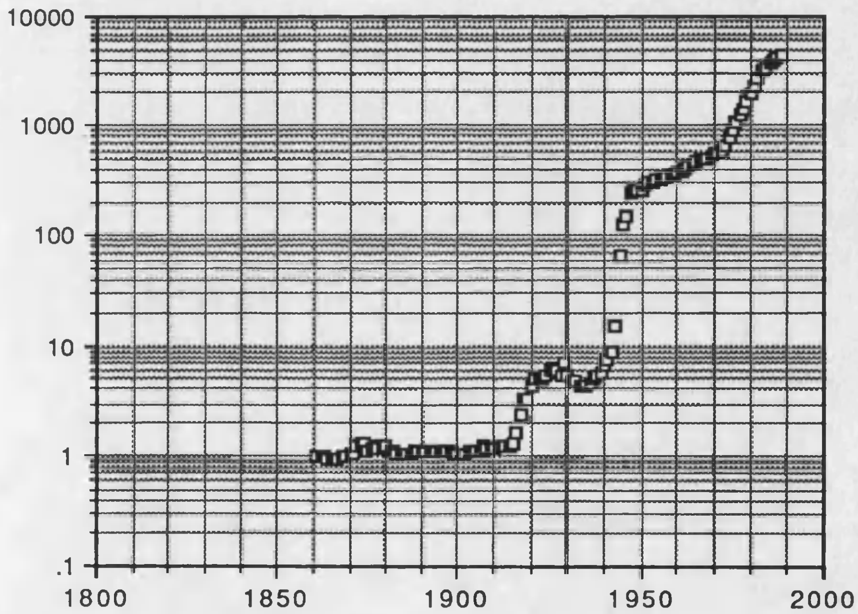
First, only extraordinary expenditure is considered, and much of that is hidden. The cost, for instance of the emergency work at the Rapanaro family's property (section 7.3.2) was probably never even costed. Likewise the regular clearing up of minor landslide debris in and around the town by council employees.

Second, details of many of the operations carried out - many sketchy in the first place - seem to have been lost. Frequent reference has been made in the dissertation to gaps in the found documents.

Third, a variety of works of various kinds have been carried out, but pinning down how much was actually done in Grassano, or even the extent to which work was done to prevent landslides, is often not possible. This is a particular problem for many of the large-scale land-reclamation programmes which have affected the municipality.

Fourth, Italy has experienced considerable price inflation since the beginning of the twentieth century. To give some comparability between the cost of the landslide works costs were converted to 1988 values (to three significant figures) using the retail price index shown in figure C.1 (calculated from Mitchell, 1981; and OECD, 1990). 1988 values are given to three significant figures in italics in square brackets. The few projects from before 1861 were assumed to be at 1861 prices (prices were generally stable in the mid-nineteenth century) but with the 1988 equivalents given to two significant figures only.

Figure C.1 Italy: price inflation



C.2 Urban landslides

1843: a total of D78.41 [*approximately L2,200,000*] was paid by Grassano for repair work on the Scalone road. The main work was: excavation, building a retaining wall, steps (ASP, Intendenza di Basilicata, 1006, 620, "Progetto, a stato definitivo, ad astimaterea de lavori occorente per la riparazione della pubblica strada distinta [?] nell'abitato di Grassano denominata Scalone").

1850: D25.2 1/2 [*approximately L690,000*] was proposed to be spent by Grassano on two retaining walls on Via Pontone (ASP, Intendenza di Basilicata, 1006, 619, "Perizia per la strada denominata Pontone del comune di Grassano").

1853: D70.00 [*approximately L1,900,000*] was proposed to be spent by Grassano for strengthening the retaining wall of Via Puntone (ibid, "Perizia suppletoria della strada Pontone").

1866: a total of D3,045.73 [*L88,900,000*] was spent by Grassano on reinforcements along Via Puntone mainly on retaining walls and embankments (ASP, Intendenza di Basilicata, 1006, 620, "Perizia per la continuazione dei lavori a [illegible] alla strada Pontone per portare al completamento").

1883: A total of L733.25 [*L3,010,000*] was paid by Grassano for repairs to Via Carmine and Via Capolegrotte (including two retaining walls) (ASM, Genio Civile, I, 836, folder: *Affari comunali Grassano*, "Lavori di sistemazione della Strada interna della via CapoleGrotte [sic] ed ora Carmine").

1902: L462.90 [*L1,900,000*] spent on the demolition of a rock mass in the Cinti area (ASP, Prefettura di Potenza, 213, 11, letter from the Genio Civile to the Prefetto, dated 19.6.1907). Grassano received a government grant of L107.95 [*L443,000*] towards the cost.

1911 to 1922: A total of L15,030.69 [*approximately L27,700,000 assuming the money to have been spent at 1917 costs*] spent on repair projects. Works included a retaining wall at Via Piazza [Corso Umberto Primo], guttering for Strada sotto la Chiesa [Via sotto la Chiesa] and Via Cinti, a retaining wall for Vico Primo Capolegrotte

(ASM, Genio Civile, I, 620, folder: *Opere di consolidamento delle frane minacciente gli abitanti (Legge 31 marzo 1904 N° 140)* "Perizia dei lavori complementari di consolidamento l'abitato di Grassano", "Relazione").

1924: L19,785.92 [*L16,300,000*] was paid for the reconstruction of a retaining wall near the Chiesa Madre. In 1925, a further L6,000 [*L4,400,000*] was spent on repairs there (ASM, Genio Civile, I, 395, folder: *Opere di consolidamento delle frane minnaciente gli abitanti: Lavoro di consolidamento dell'abitato di Grassano: Ricostruzione del muro di sostegno del piazzale del Chiesa Madre*).

1932 to 1933: L120,000 [*L119,000,000*] spent on repairs following the storms of 1930 and 1931. Main works were: the demolition of an overhanging rock face under Vico Terzo Chiesa (ASM, Genio Civile, I, 347).

1934: L13,707.63 [*L14,300,000*] was authorized to be spent on further repairs (ibid).

1934: L29,565.30 [*L30,900,000*] was paid by the Genio Civile for repairs to the damage caused by the 1934 storms. The main works were: around the cemetery and the springs, and Via Tilea (ibid, file: *lavori di riparazione danni prodotti dalle alluvioni del 1934 delle opere di consolidamento di Grassano*).

1934: L40,000 [*L41,700,000*] authorized for consolidation in Grassano. The main works were: channelling the Fosso Santo Domenico and the Fosso Monteoliveto (ASM, Genio Civile, I, 471).

1935: A total of L33,075 [*L34,000,000*] paid for general works of consolidation around the town. This included the insertion of check dams in the Fosso Fontana (ASM, Genio Civile, I, 836, file: *Lavori di picolla bonifica ed interventi relativi all'abitato di Grassano*).

1936: L4,947.25 [*4,720,000*] spent by Grassano for the repair of retaining walls on municipal roads (ASM, Genio Civile, I, 836, folder: *Grassano: affari varii,* Deliberazioni del Podestà 1936, 88).

1937: L3,503.83 [*L3,050,000*] was paid for the extension of a retaining wall (ASM, Genio Civile, I, 347, file: *Lavori di consolidamento dell'abitato di Grassano nell* [sic] *Fosso Monte Oliveto*).

1937: L2,440.98 [*L2,130,000*] was paid for consolidation works in the Fosso Monteoliveto. Damage by the storms of 1932 and 1933 had threatened the town (ibid, file: *Lavori di riparazione danni alluvionali negli anni 1932 e 1933. Consolidamento dell'abitato di Grassano*).

1937 to 1939: L56,000 [*approximately L45,300,000 assuming the money spent at 1938 costs*] was spent on the repair of Fosso Monteoliveto (ASM, Genio Civile, I, 471).

1940: L50,000 [*L33,300,000*] was allocated for the construction of retaining walls in the Scalone, Puntone, and Calvario areas (the project was not completed) (ASM, Genio Civile, I, 482, folder: *Perizia dei lavori di pronto soccorso da eseguire in alcune zone dell'abitato di Grassano*, "Perizia dei lavori di pronto soccorso da eseguire in alcune zone dell'abitato di Grassano"; and folder: *Rione Calvario Grassano*, letter from Catarina and Giuseppina Vignola to the Genio Civile, dated 1.8.1942).

1942: L5,300 [*L2,640,000*] was spent on repairs to a retaining wall in Via Madonna delle Neve (ASM, Genio Civile, I, 395, loose papers).

1942: L19,759.83 [*L9,850,000*] was paid for the construction of a retaining wall in the Calvario area, and for the demolition near it of a wall and a dwelling following the storms of autumn 1940 (ASM, Genio Civile, I, 482, un-named folder, letter from the Ministero dei Lavori Pubblici to the Genio Civile, dated 23.6.1942).

1942: L15,720 [*L7,830,000*] was paid for the reconstruction of the collapsed retaining wall at Via Roma (ibid, folder: *Lavori di ricostruzione della parte crollata del muro al ramparte di via Roma nell [sic] abitato di Grassano*).

1947: L3,697,216 [*L65,400,000*] was paid for a number of consolidation works. The main works were: a retaining wall by the Chiesa Purgatorio, drainage works in Rione Pontone [Calvario], repairs to the check dams in the Fosso Fontana (ASM, Genio Civile, I, 395, folder: *Grassano: consolidamento rione Purgatorio ecc.* "Perizia dei lavori di consolidamento del Rione Purgatorio della via S. Lucia, del largo Puntone e del Fosso Fontana dello abitato di Grassano").

1948: L1,566,360 [*L26,200,000*] was authorized to be paid for the consolidation of the Fosso Fontana. The work was to be completed by 13 August 1950. (ASM, Genio

Civile, I, 799, folder: *Consolidamento Fosso Fontana. Contabilità*, "Relazione su conto finale".)

1950: L3,357,760 [*L56,000,000*] was spent on three new check dams in the Fosso Fontana and drainage works for Rione Calvario (ibid, folder: *Lavori di consolidamento del Rione Calvario, e Fosso Fontana*, "Relazione"; and ibid, "Decretto di Svincolo di Canzione").

1950 to 1951: L3,416,880 [*approximately L52,300,000 assuming the money spent at 1951 costs*] was paid for the repair of a retaining wall in Rione Calvario, drainage works in Rione San Sofia and Rione Calvario, a new retaining wall (extending the existing one) in Via Roma (ibid, folder: *Perizia dei lavori di consolidamento del Rione Pontone, S. Sofia e Calvario in abitato di Grassano. Liquidazione finale*, "Stato finale dei lavori eseguiti a tutto il 28-12 1951").

1951: a total of L7,968,960 [*L122,000,000*] was paid for a number of works including the repair of the perimeter of the Chiesa Purgatorio and the construction of a retaining wall in Rione Meridionale (ASM, Genio Civile, I, 14, folder: *Progetto dei lavori di consolidamento dei Rioni Meridionale S. Innocenzo, Piazza e Purgatorio dello abitato di Grassano*).

1951: L5,000,000 [*L76,000,000*] was allocated for the consolidation of the built-up area south of the Via Meridionale (ibid, folder: *Lavori di consolidamento del nuove rione fra la via meridionale e la strada apullo lucana in GRASSANO*).

1952: L4,366,690 [*L64,000,000*] was spent on the consolidation of the newly built-up area south of the Via Meridionale (ibid, folder: *Perizia di lavori di consolidamento del Rione Meridionale in abitato di Grassano*, "Relazione"; and ibid, affidavit of execution of work, dated 28.11.1952).

1953: a total of L4,000,000 [*L57,600,000*] was authorized for expenditure in the Rione Italia, Rione San Rocco, and Rione Monteoliveto which included the repair and improvement of old retaining walls (ibid, file: *Perizia dei lavori di consolidamento del Rione Italia - S. Rocco e Monteoliveto dell'abitato di Grassano*).

1954: a total of L3,800,000 [*L53,000,000*] was allocated for works including a retaining wall near the town hall (ibid, folder: *Perizia dei lavori di consolidamento* *del Rione Processionale, Capo Le Grotte, S. Domenico e Piazza dell'abitato di Grassano,* "Relazione").

1955: L400,000 [*L5,450,000*] was authorized to be spent on consolidation of the banks of the Fosso Fontana. One half was to be paid by the municipality, one half by the Ministero dell'Agricoltura e delle Foreste. A total of 500 working days were allocated, with twenty-four workers each paid L800 a day (AMG, 1954, X, folder: *Sistemazione Fosso della Fontana*, "Ministero dell'Agricoltura e delle Foreste, Decreto Ispetorale di autorizzazione e concessione del contributo, N 1/98B"; and the anonymous list of workers.)

1958: L7,000,000 [*L85,400,000*] was allocated for the consolidation of Rione Calvario (ASM, Prefettura di Matera, III, 110, 1808, contract dated 26.11.1958).

1959: L447,654.99 [*L5,460,000*] was paid for drainage works in the Rione Calvario and other areas (ASM, Provveditorato regionale alle Opere Pubbliche, I, 207, folder: *COMUNE DI GRASSANO: PERIZIA dei lavori di somma urgenza occorenti per tutela della pubblica incolumità ed a salvagardia dell'ingiene pubblica nell'abitato*, decree by the Provveditore, numero di protocollo IV/11487).

1969: L2,212,000 [*L18,800,000*] was allocated for the demolition of houses in Rione Calvario (AMG, Deliberazioni della Giunta Municipale, 1969, 256).

1973: L.2,527,980 [*L16,800,000*] was allocated for *cantiere* 26751/R, the consolidation of the Fosso Fontana and Fosso Maruggio Secondo. This followed *cantiere* 26563/R in the same place. Fifteen workers were paid for 51 days' work, which included reforestation, resurfacing of tracks, and the repair of walls. (AMG, file: *CANTIERE N^{O} 26751/R SISTEMAZIONE FOSSI FONTANA*, "Relazione tecnica illustrativa", and "Preventivo di spesa").

1974: L21,000,000 [*L117,000,000*] was allocated for repair works to the cemetery, including the demolition of dangerous walls, drainage works, the construction of new walls, the repair of steps and paths (UTMG, file: *Nuovo Cimitero*, "Perizia dei lavori di sistemazione della ricinzione, muri di sostegno, casa del custode, viali e gradinate interne nel civico cimitero", "Perizia").

1974: L3,476,400 [*L19,300,000*] was allocated for *cantiere* 26563/R, for the consolidation of the Fosso Fontana and the Fosso Marruggio Secondo. Fifteen workers were paid for 51 days (AMG, file: *CANTIERE DI RIMBOSCHIMENTO Nº 26563 FOSSI DELLA FONTANA*, "Relazione finale").

1975: L3,772,000 [*L17,800,000*] was spent on *cantiere* 27199/R the consolidation of the Fosso Fontana and the Fosso Marruggio Secondo. Fifteen workers were employed for 51 days (AMG, file: *CANTIERE RIMBOSCHIMENTO Nº 27199*, letters from the Ministero del Lavoro e della Previdenza Sociale to the Comune di Grassano, dated 25.8.1975 and 15.12.1975).

1978: L1,050,000 [*L3,250,000*] was paid for the repair of the cemetery (AMG, Deliberazioni della Giunta Municipale, 1978, 366).

In 1979, after the devolution of the workfare programmes, the region became responsible for their administration. L300,000,000 [*L808,000,000*] was allocated for reforestation and consolidation work in Grassano and Grottole. At Grassano, nine check dams were built in the Fosso Fontana in order to slow erosion in the channel. The cost of the work in Grassano was probably at least L200,000,000 [*L540,000,000*] (UTMG file: *Progetto speciale aree interne - programma 1979 - lavori di sistemazione idraulico-forestale interesanti i comuni di Grassano e Grottole in Provincia di Matera*, "Relazione").

1981: L800,000,000 [*L1,510,000,000*] was allocated for the construction of a check dam, drainage works, a retaining basin, the repair of gulley walls and the canalization of drainage water in the Fosso Spinetto (UTMG, *PERIZIA dei lavori di consolidamento dell'abitato di Grassano, mediante imbrigliamento e sistemazione del fosso "Spineto" (1° tratto a valle)*, "Relazione").

1982: L845,000,000 [*L1,360,000,000*] was allocated for the following work: In the Fosso Fontana - construction of three check dams, drainage works, repair of gulley sides. Fosso Marruggio Secondo - construction of a check dam, a retaining basin, drainage works. (UTMG, *PERIZIA dei lavori di consolidamento dell'abitato di Grassano, mediante l'imbrigliamento e la sistemazione di un tratto del fosso "Fontana" e del fosso "Marruggio II"*, "Perizia".) This project was extended in 1984, absorbing the unspent surplus (UTMG, folder: *Lavori di consolidamento dell'abitato di Grassano, mediante imbrigliamento e sistemazione di un tratto del fosso Fontana e del fosso Marruggio II*, "Relazione").

1983: L26,000,000 [*L36,700,000*] was allocated for the construction of a retaining wall at Pozzo delle Vigne near the SS7 (AMG, Deliberazioni del Consiglio Comunale, 1983, 82).

1984: L42,833,332 [*L54,500,000*] was paid for the repair of Via Tilea (AMG, Deliberazioni del Commisario Straordinario con i Poteri del Consiglio Comunale, 1984, 103).

1985: L980,000,000 [*L1,140,000,000*] was authorized to increase the capacity of the canalized channel in the Fosso Marruggio Secondo, down to its confluence with the Fosso Fontana (UTMG, *Lavori di consolidamento dell'abitato di Grassano, mediante imbrigliamento e sistemazione di un tratto del fosso Fontana e del fosso Marruggio II*, "Perizia di variante e suppletiva").

1986: L510,000,000 [*L561,000,000*] was allocated by the regione Basilicata for consolidation of the Fosso Fontana. The work involved the construction of a check dam, calming of flow in the gulley, drainage canalization, and drainage works along the channel. (UTMG, file: *Perizia dei lavori di consolidamento dell'abitato di Grassano mediante la sistemazione in tratto del Fosso Fontana*, "Relazione".)

1987: ANAS allocated L471,000,000 [*L495,000,000*] for the consolidation of 300 m of the SS7 (from Kilometre 525.500 to Kilometre 525.800) (UTANAS, file: *Strada Statale: nr. 7 "Via Appia". Tronco: S.S. Nr. 277 - Grassano. Lavori: Urgenti di consolidamento, sostegno e protezione del corpo stradale in frana tra i Km. 520+000 e 536+000. (Cap. 505.) Perizia: di Variante Tecnica e Suppletiva senza aumento di spesa*, "Relazione".) This area had been subject to landslides for at least thirty years, but the amount spent on repairs over that period is unknown (conversation with a senior ANAS official). The work included the construction of a retaining wall and the use of anchoring piles.

In the period 1988 to 1991 three major projects were begun, at a total cost of approximately L8,300,000,000 (interviews with Giuseppe Vignola, 22.5.91; and Michele Lacertosa, 24.5.91).

• In 1989 a L5,500,000,000-project was begun by the Basilicata region for consolidation under the provisions following the Senise disaster of 1986 (see Regione Basilicata, 1987). This work involved consolidation on the south slope of the Fosso Spinetto, the Fosso dei Lupi, and on the north slope of the Fosso Tilea.

• In 1989 the Corpo Forestale began a project to reforest and consolidate the Fosso Fontana and the cemetery, at a cost of approximately L1,000,000,000.

• In 1990 ANAS began a L1,784,490,000-project to consolidate the site of the Petrino landslide on the SS7.

C.3 Land-reclamation projects

The evidence on the extraordinary-spending on urban landslides does not, and cannot, show the full impact of landslides on Grassano. Ironically, given the refusal to acknowledge landslides as "usual", there has been widespread ordinary spending on preventing them.

In an interview with Engineer Rocco Dichio (24 May 1988) covered some of the reasons why. Dichio had been at Grassano since 1 January 1984, and in addition to his first-hand knowledge of projects since that date, had second-hand awareness of preceding years. Since 1980, he estimated, there had been about 15 retaining walls built in the town; at a total cost of about L1.5 billion. In 1988 they were built no more frequently than before the earthquake of 1980. Similarly with road guttering, which is standard for all new projects, such as the resurfacing of Via Capitano Pirone.

Since 1980 there had been perhaps six or seven ordinances of evacuation issued which had been unconnected with the earthquake/paleoslide: of which only one (the villa on the SS7 in the Petrino district) was the result of landslides.

In addition to the costs incurred in the response to urban landslides, there have been wider-based reclamation programmes undertaken often, as the examples quoted in this appendix show, including quite explicitly the reduction in intensity of landsliding outside the town.

By August 1932: A total of L50,000 [*L46,600,000*] had been spent (about L40,000 [*L37,000,000*] from the Ministero dell'Agricoltura e Foreste, and about L10,000 [*L9,320,000*] from the Prefectorate) on anti-malarial works in Grassano, Tricarico, Stigliano, and Venusio (ASM, Genio Civile, I, 557, letter from the Provveditorato alle Opere Pubbliche to the Genio Civile, dated 6.8.1932).

1952 to 1966: six projects were undertaken, with a total of L74,862,446 spent in the municipality [*between L678,000,000 (spent at 1966 prices) and L1,130,000,000 (spent at 1952 prices) - an average of L113,000,000 to L188,000,000 each*]. Sixty-five check dams were built, twenty-one kilometres of watercourses were repaired, and twenty hectares of land was reforested in addition to upgrading the woodlands elsewhere (CBMVB, *1988 lavori di Forestaz* [sic] *Tricarico*, "Lavori in Amministrazione Diretta").

After 1966, other sources of finance were turned to, notably the Basilicata region's *Piano Forestale*, and an average of about L50,000,000 was spent each year until 1976 (the figure then dropped) [*between a maximum of L543,000,000 (spent at 1966 prices) and minimum of L203,000,000 (spent at 1976 prices)*]. The Consorzio has reforested about 200 ha in Grassano since the 1950s; though only maintenance is now carried out, on which ten workers were employed in 1988. (Interview with Geometro Benevento of the Consorzio di Bonifica della Media Valle del Basento, 14.7.1988.)

At least ten *cantieri di rimboschimento* have been instituted in Grassano. In 1954 L7,962,816 [*L111,000,000*] was allocated for *cantiere* 7072R in Cugno di Noce. The project lasted 102 days and employed 100 workers, 3 supervisors, and 1 senior supervisor (AMG, file: *CANTIERE DI RIMBOSCHIMENTO N. 7072/R*).

1954: L7,943,221 [*L111,000,000*] was allocated for *cantiere* 8496R at Cugno di Noce (Fosso Caracoia), for the construction of check dams and the reforestation of 8.5 ha. The same number of people were employed as for the previous project (AMG, file: *CANTIERE DI RIMBOSCHIMENTO NR 8496R*, "Relazione tecnica illustrativa").

1958: L3,710,500 was allocated for *cantiere 14398R*, and reforestation in Cugno di Noce and Golfi. The project included the construction of four check dams and reforestation of 26 ha. It employed fifty workers, two supervisors, and one senior supervisor, for seventy-six days (AMG, file: *CANTIERE DI RIMBOSCHIMENTO N. 14398/R*, "Cugno di Noce e Golfi", "Relazione tecnica illustrativa"; and "Preventivo di spesa".)

1958 to 1959: the Ente per lo Sviluppo dell'Irrigazione e la Trasformazione Fondaria in Puglia e Lucania authorized the investment of L111,090,000 [*approximately L1,350,000,000 assuming 1959 prices*] on the repair of the Basento river in Calciano and Grassano. (ASM, Genio Civile, III, 224, 872.)

1959: L3,959,100 [*L48,300,000*] was allocated for *cantiere* 15212R, reforestation of Cugno di Noce (indicated as a prolongation of *cantiere* 9535/R, details of which it was not possible to find). Fifty workers were employed for 76 days. (AMG, file: *CANTIERE DI RIMBOSCHIMENTO N. 15212/R.*)

1961: L76,200,000 [*L878,000,000*] was authorized to be spent on a four-year project in Grassano, Grottole, and Miglionico. The project involved the construction of 76 check dams, the reforestation of 40 ha, the construction of 6 km of access roads, the construction of three cabins for storage and overnight stops. (The exact extent of work in Grassano is not known.) (ASM, Genio Civile, III, 115, 521, "Relazione".)

1961: The Consorzio di Bonifica della Valle Bradano allocated L97,800,000 [*L1,130,000,000*] (from Cassa per il Mezzogiorno funds) for land reclamation projects in Grottole, Grassano, Tricarico, and Matera. L65,428,082 [*L754,000,000*] of the total was allocated for check dams, L14,860,583 [*L171,000,000*] for reforestation, the rest for extra works, other expenses, and general expenses. (ASM, Genio Civile, III, 223, 767, "Relazione".)

1961: a total of L160,000,000 [*L1,840,000,000*] was allocated for the protection of the SS7 between Grassano and Matera. The 3,011 m inside Grassano had gutters built or replaced, check dams were built, and the road was resurfaced. Ninety-two percent of the finance came from the Cassa per il Mezzogiorno, 8% from the local proprietors (ASM, Genio Civile, III, 48, 233.)

1961: L4,038,900 [*L46,500,000*] was allocated for *cantiere* 19336/R, reforestation of Cugno di Noce. It was envisaged to be a continuation of *cantiere* 9535/R, and to carry out repairs on the sites of 7072/R, 8496R, and 15212R. Twelve hectares were forested. Fifty workers were employed for 76 days, with 2 supervisors, and 1 senior supervisor (AMG, file: *CANTIERE RIMBOSCHIMENTO N. 19336/R*, "Relazione tecnica illustrativa", and "Preventivo di spesa").

In about 1961: L875,500 [*L10,100,000*] was allocated for *cantiere* 20508/R, the continuation of 19336/R. Ten workers were employed for 76 days. The work involved reforestation on the site of 19336R, and the repair of previous works, earth moving, and drainage works (AMG, file: *CANTIERE DI RIMBOSCHIMENTO n. 20508/R CUGNO di Noce*, "Relazione tecnica illustrativa per prolongamento cantiere di rimboschimento N. 19336/R e cure culturali ai rimboschimenti eseguiti con precedenti cantieri").

1962: the Ente di Sviluppo's second major intervention in Grassano was in 1962. It organized the expenditure of L55,180,000 [*L606,000,000*] on the repair of the Torrente Acquafredda in the municipalities of Tricarico, Grassano, and Calciano. Reforestation was carried out from 200 m south of the SS7 down to the Basento river, six check dams were built, of which one was shared with Tricarico (ASM, Genio Civile, III, 19, 105).

1966: L6,000,000 [*L54,300,000*] was allocated (L1,020,600 [*L9,240,000*] to be spent on Grassano) for expenditure on reforestation and erosion control in Ferrandina, Grassano, Matera, Miglionico, Montescaglioso, Pisticci, Pomarico, Stigliano, and Tricarico, by the Ministero dell'Agricoltura e delle Foreste (ASM, Genio Civile, III, 425).

1967: L1,277,670 [*L11,300,000*] was allocated for *cantiere* 23101/R in Cugno di Noce. Twenty workers were employed for 51 days (AMG, file: *CANTIERE DI RIMBOSCHIMENTO N. 23101/R*).

1967/8: At the expense of the Cassa per il Mezzogiorno, the Consorzio di Bonifica di Bradano e Metaponto authorized the payment of L200,100,000 [*L1,760,000,000*] in Grottole and Grassano. The project involved the construction of 80 new check dams, and the maintenance of 45 old ones (56 of the 125 were in Grottole and 69 in Grassano). Reforestation (at a specified density of 2,000 saplings per hectare), the clearing of 9 km of watercourses, and the construction of an access road were ordered (ASM, Genio Civile, III, 6, 21, "Relazione").

1969: L5,500,000 [*L46,800,000*] was allocated by the Ministero dell'Agricoltura e delle Foreste for Ferrandina, Grassano, Matera, Miglionico, Montescaglioso, Pisticci, Pomarico, Stigliano, and Tricarico. Work included reforestation and the repair of check dams. L1,441,000 [*L12,300,000*] was spent in Grassano (ASM, Genio Civile, III, 80, 431, "Relazione").

1970: The Ministero dell'Agricoltura e delle Foreste allocated L1,939,450 [*L15,800,000*] to Grassano (*cantiere di lavoro* 20508/R) for the canalization of surface water and the construction of check dams. The total project cost L5,600,000 and included work in Matera (three sites), Grassano, and Pisticci. (ASM, Genio Civile, III, 81, 450, "Relazione"; and "Stima dei lavori").

<u>1971:</u> L5,300,000 [*L41,000,000*] was allocated by the same ministry to be spent on reforestation and erosion control in Matera, Grassano, and Pisticci (L2,740,589 allocated for Grassano - for *Cantiere di lavoro* 20508/R) (ASM, Genio Civile, III, 81, 440, "Relazione"; and ibid, "Stima dei lavori").

<u>1973:</u> L3,704,185 [*L24,600,000*] plus an unspecified share of the costs was allocated for the Ministero dell'Agricoltura e delle Foreste *cantiere di lavoro* 20508/R (from a project of L8,000,000 which included Grassano and Policoro) to repair damage done during the spring of that year. The aims included "Rejuvenation... consolidation of landslipped land... improvement of landslide-prone land... the opening of a service road..." (ASM, Genio Civile, III, 81, 447, "Relazione", translated.)

<u>1973:</u> L8,000,000 [*L53,100,000*] was allocated by the Ministero dell'Agricoltura e delle Foreste for reforestation and the construction of check dams and drainage works, after the torrential rains of that year (ASM, Genio Civile, III, 82, 473, "Relazione"; and "Stima dei lavori").

<u>1973:</u> L299,000,000 [*L1,980,000,000*] was authorized for work in Grottole, Grassano, and Tricarico. A total of 13 check dams were built (of which 8 were wholly, and two partly in Grassano), and 108.7174 ha in Grassano was to be reforested. In addition, minor works were carried out including the signposting of potential fire hazards, 12 km of roads, and the repair of watercourses (ASM, Genio Civile, II, 12, 19, "Relazione").

<u>1973 or 1974</u>: L100,000,000 [*L663,000,000 or L556,000,000*] was authorized to be spent on the construction of about 100 check dams, and the clearing of watercourses in the Bilioso valley in Tricarico, Grassano, and Grottole. About 40 of the check dams were in Grassano (ASM, Genio Civile, III, 55, 294, "Relazione").

<u>1974:</u> the Ministero dell'Agricoltura e delle Foreste authorized L6,000,000 [*L33,300,000*] to be spent on *cantiere di lavoro* 20508/R for the construction of a check dam, and consolidation works (ASM, Genio Civile, III, 7, 28).

<u>1975:</u> L8,000,000 [*L37,800,000*] was allocated by the Ministero dell'Agricoltura e delle Foreste for work on *cantiere di rimboschimento* 20508/R "to provide a further brake to landslides, which occurs with the passing seasons..." The work included reforestation and the construction of check dams (ASM, Genio Civile, III, 82, 468, "Relazione"; and "Stima dei Lavori", translated).

1976: L200,000,000 [*L812,000,000*] was authorized for reforestation and the construction of check dams in Grottole and Grassano. A total of 10 check dams were to be constructed (only 1 in Grassano), and 27.9072 ha (of which about 60% was in Grassano) were to be reforested after fire damage in 1974 (ASM, Genio Civile, III, 33, 160, "Relazione"; and "Stima dei lavori").

1976: L100,000,000 [*L406,000,000*] was allocated for the increased protection of about 175 ha already reforested, and the construction of check dams (ASM, Genio Civile, III, 62, 308, "Relazione").

Appendix D: Geotechnical data on Grassano

The variety of recent geotechnical studies on the area around Grassano have found the following data:

Cotecchia, Del Prete, and Puglisi (unpublished, 1981) found that for the clays, the fraction smaller than 0.002 mm was between 36% and 53% (with a mean of 43.13%). The fraction between 0.002 and 0.06 mm was between 42% and 60% (with a mean of 53.19%). The physical characteristics of the clays were found to be as follows:

Density = 2.05 g per cm^3.
Density of constituent solids = 2.65 g per cm^3.
Index of voids = 0.57.
Dry weight of unit of volume = 1.69 g.
Porosity = 36%.
Natural water content = 21.50%.
Liquid limit = 42.8% to 57.4% (with a mean of 48.26%).
Index of plasticity = 20% to 30.8% (with a mean of 24.96%).
Index of cohesion = 0.94 to 1.21 (with a mean of 1.07).
Resistance strength (non-draining) = 0.5 to 5.35 kg per cm^2 (with a mean of 1.92 kg per cm^2).
Undrained resistance = >2 kg per cm^2 (with the exception of one test at between 1.1 and 1.6kg per cm^2).
Critical angle = 19.5° to 26° (with a mean of 21.93°).
i' = 0 to 0.55 kg per square cm (with a mean of 0.3 kg per cm^2).
Residual critical angle = 11.5° to 20.0° (with a mean of 13.46°).

Cotecchia and Del Prete (unpublished, 1982) found the following in their clay samples:

Specific weight = 2.01 to 2.16 kg per cm^3 (with a mean of 2.9 kg per cm^3).
Dry density = 1.74 g per cm^3.
Mean water content = 20.1%.
Degree of saturation = 92.3% to 100.0%.
Mean liquid limit = 43.3% (with a standard deviation of 5.2%).
Index of plasticity = 18.8%.

Index of cohesion = 0.81 to 1.16 (with a mean of 0.96): solid-plastic.
Cohesion = 0.53 kg per cm^2.
Critical angle = 23°.

Boenzi (unpublished, 1973) described the situation a little differently. He wrote that the clays are of inorganic origin and medium plasticity. They have a clay fines content of 35% to 50%, and a carbonate content of 25% to 30%, a liquidity limit of about 48%, an index of plasticity of 25%, and a cohesion of about 4.5 kg per cm^2 at rupture.

To the east of the town, at the very edge of the clay deposit, Rapisardi, Vignola, and Vignola (unpublished, 1977) found the following:

Wv = 21.6%
Density = 2.87 g per cm^3.
dv = 1.96 g per cm^3.
ds = 1.61 g per cm^3.
Liquid limit = 54.9%.
Plastic limit = 30.8%.
Ia = 1.2.
Ip = 1.1 kg per cm^2.
Residual cohesion = 0.9 kg per cm^2.
Critical angle= 7°.

Most particles in the sandstones are between 0.2 and 2 mm. The sandstones have a resistance of around 1 kg per cm^2 (compression test) with some of the more cohesive samples giving higher resistance. Rapisardi, Vignola, and Vignola (unpublished, 1977) described the sandstones to the east of the town as marly.

Wu = 5%.
Density = 2.69 g per cm^2.
Permeability = $7x10^{-4}$: "good permeability", at the limits of "low permeability" (ibid, 7).

Analysis of the detritus mantle has proved difficult. Rapisardi, Vignola, and Vignola (ibid) found the area to be "very heterogeneous" (page 7). But without in-situ tests, they were unable to provide analysis. Cotecchia and Del Prete (unpublished, 1982) gave data - though this should be treated with some circumspection, given the caution on heterogeneity.

Specific weight = 2.0 to 2.05 tonnes per m^3.

Liquid limit = 35% to 40%.

Index of plasticity = 20%.

Water content = 22.5%.

Assumed cohesion = 0 kg per cm^2.

Assumed critical angle = 15° to 20°.

Where analysis was possible:

Density = 2.0 to 2.1 g per cm^3.

Cohesion = 0 kg per cm^2.

Critical angle = 20° to 26°.

Appendix E: The placenames of Grassano

Place-name analysis was used to give information on past patterns of landuse in Grassano. It has been used for the purpose before (Hooke and Kain, 1982) and provides an important source of information on past landuse in Basilicata (Racioppi, 1876). Placenames have already been used in analyses of slope-instability in Southern Italy: Almagià (1910) noted the prevalence of placenames that were linked to slope-instability; and Puglisi (1977) commented on the usefulness of placenames in the study of deforestation.

The names of the thirty-four districts identified in the 1819 catasto were used for analysis (the uses indicated must predate that document). The districts' names fall into the following categories:

- Information on landuse:

  Serra Martella (*serra* probably refers to a hill, perhaps a wooded hill. It means "saw", or "mountain chain" - Prati, 1951; "mountain chain" or "mountain" - Battisti and Alessio, 1950-1957. *Martello* probably refers to *mirtelli*, myrtle trees).

  Capolaserra (*capo*: "top". *Serra*: as before).

  Difesa (*difesa*: an area belonging to feudal proprietors, the area would usually be wooded).

  Serra (as before). The summit of the Serra Martella.

  Piano di Pepe (*piano*: "plain". *Pepe*: "pepper". Hence an area in which peppers were grown).

  Cugno di Noci (*cugno*: "wedge", hence interfluve - Mennona, 1977. *Noci*: "nuts". Hence an interfluve with nut trees). Wild nuts are still found there.

  Piano di Focaccia (*piano*: "plain". *Focaccia*: a type of pizza bread. Hence an area in which wheat was grown for flour).

  Serrauzzi (*serra*: as before).

  Spineto (*spinetto*: "small spine", hence: thorn trees).

  Macchia (*macchia*: degraded woodland).

  Calanconi (*calanchi*: area subject to badland erosion or landslides).

- Information on location:

Manca (*mangùs'*: "open to the north" - Mennona, 1977; "lacking", or "on the left", or "unlucky" - Prati, 1951).

Pianella (*pianella*: "small plain").

Le Manche (*manche*: plural of *manca*).

Coste di Rizziano (*coste*: "slopes").

Piano di Croce (*Piano*: "plain". *Croce*: "cross").

• Description of a dominant feature in the contrada (a land feature, a chapel, and soforth).

Cupolo (*cupolo*: "dome", hence "hill").

Santa Lucia (perhaps a chapel).

Acquasalsa (*acqua salsa*: "salt water", the name of the spring and the Fosso Acquasalsa).

Carmine (named after the Franciscan order's church Santa Maria del Carmine - see Altavilla, 1988).

Sotto la Chiesa (means: "under the church").

Acquafredda (*acqua fredda*: "cold water", the name of the spring and the Fosso Acquafredda).

Santa Maria della Neve (named after the church of the same name).

Sangiorgio (perhaps a chapel).

Fiumara (*Fiume*: "river").

L'Angelo Lontano (perhaps a chapel).

Fontana (name of the spring).

Strada (*Strada*: "road").

Santangelo Lontano (perhaps a chapel).

• Other names of an ambiguous or unknown origin: Mantra; Forchi; Golfi (also spelt "Eolfi").

Appendix F: Political power in Grassano

F.1 Introduction

Most of Grassano's political history has been dominated by conservative political forces. Until the Fascist period, local politics remained a largely factional, rather than ideological contest (Camera dei Deputati, 1954; Levi, 1982; Bolettieri, 1991): since the end of the last world war, politics has been generally controlled by the Christian Democrats, though they lost their hold on the town for a short period in the 1970s.

A list held in the town hall archive at Grassano gives the names of the council leaders since 1852. From discussion with council staff, it was possible to identify the political affiliations of the post-war mayors.

1852-31.12.1854	Francesco Lerose	(Sindaco)
1.1.1855-31.12.1857	Michele Viscera	(Sindaco)
1.1.1858-31.12.1864[?]	Giuseppe Falcone	(Sindaco)
1.1.1865-26.5.1866	Andrea Ilvento	(Sindaco)
27.5.1866-1872	Michele Viscera	(Sindaco)
1872-30.9.1876	Domenico de Felice	(Sindaco)
1.19.1876-30.6.1881	Ferdinando Materi	(Sindaco)
1.7.1881-11.2.1882	Domenico Repullone	(Sindaco)
12.2.1882-31.7.1884	Domenico de Felice	(Sindaco)
1.8.1884-1895	Ferdinando Materi	(Sindaco)
1895-21.12.1897	Domenico Repullone	(Sindaco)
22.12.1897-31.1.1904	Domenico Tortorelli	(Sindaco)
1.2.1904-14.1.1908	Domenico Repullone	(Sindaco)
15.1.1908-9.8.1914	Domenico Tortorelli	(Sindaco)
10.8.1914-27.2.1920	Enrico Materi	(Sindaco)
28.2.1920-12.11.1920	Innocenzo Decuzzi	(Sindaco)
13.11.1920-31.12.1923[sic]	Giuseppe Motta	(Sindaco)
1.1.1923-30.11.1924[?]	Vincenzo de Carli, and Noitana Gavina	(Reale Commisarii)
1.12.1924-31.3.1927	Enrico Materi	(Sindaco)
1.4.1927-31.12.1929	Enrico Materi	(Podestà)
1.12.1934[*sic*]-14.9.1936	Carlo Mazarella	(Podestà)
17.9.1936-6.8.1938	Alfonso Santoro	(Commisario Prefettizio)
10.3.1938-27.1.1939	Nicola Curzio	(Commisario Prefettizio)
28.1.1939-15.12.1940	Michele Decuzzi	(Podestà)
16.12.1940-30.9.1941	Francesco Nardelli	(Podestà)
1.10.1941-29.1.1943	Vincenzo Maciose	(Commisario Prefettizio)
30.1.1943-21.10.1943	Nicola Tortorelli	(Commisario Prefettizio)
22.10.1943-29.12.1943	Giovanni Spagna	(Commisario Prefettizio)
30.12.1943-30.9.1944	Ettore Vulcano	(Commisario Prefettizio)
1.10.1944-29.5.1945	Giuseppe Pirrone	(Commisario Prefettizio)

30.5.1945-31.7.1945	Girolamo Schiavone	(Sindaco [DC])
2.8.1945-27.9.1945	Vincenzo Maciose	(Commisario Prefettizio)
28.9.1945-29.11.1946	Incenzo Sigilano	(Commisario Prefettizio)
30.11.1946-9.6.1952	Innocenzo Bolettieri	(Sindaco,Lista Civica)
10.6.1952-31.1.1953	Tomasso Celiberti	(Sindaco, DC)
1.2.1953-3.4.1955	Vincenzo Passarella	(Sindaco, Lista Civica)
4.4.1955-27.6.1956	Giuseppe Candela	(Sindaco, DC)
28.6.1956-30.9.1958	Emanuele Lopergolo	(Sindaco, DC)
1.10.1958-30.11.1960	Gaetano Ambrico	(Sindaco, DC)
1.12.1960-15.1.1965	Pietro Calabrese	(Sindaco, DC)
16.1.1965-1.9.1970	Antonio Bonelli	(Sindaco, DC)
6.9.70-14.8.1975	Tomasso Celiberti	(Sindaco, DC)
15.8.1975-15.9.1975	Luigi Daraio	(Sindaco, PCI)
16.9.1975-9.8.1976	Giuseppe Calculli	(Commisario Prefettizio)
9.8.1976-6.12.1977	Luigi Daraio	(Sindaco, PCI)
14.2.1978-2.2.1979	Luigi Daraio	(Sindaco, PCI)
2.2.1979-30.6.1979	Giuseppe Calculli	(Commisario Prefettizio)
1.7.79-18.10.1983	Nicola Vignola [1943-]	(Sindaco, DC)
19.10.1983-13.8.1984	Achile Lenge	(Commisario Prefettizio)
14.8.1984-1989	Salvatore Incampo	(Sindaco, DC)
1989 to the present, 1993	Salvatore Incampo	(Sindaco, DC)

The election results from 1952 were as follows:

25.12.1952 (Ministero dell'Interno... [etc], 1956)

Electorate - 4895, voters - 4291 (of which 4067 cast valid votes), turnout - 87.7%.

	SC	DCA	Destra
votes	1222	2296	549
% of votes	30.0	56.5	13.5
seats	4	16	0

27.5.1956 (Ministero dell'Interno... [etc], 1958)

Electorate - 4781, voters - 4345 (of which 4091 cast valid votes), turnout - 90.9%.

	SC	DC	Destra	Miste
votes	1697	1743	483	168
% of votes	41.5	42.6	11.8	4.1
seats	4	16	0	0

6.11.1960 (Ministero dell'Interno... [etc], 1962)

Electorate - 4902, voters - 3949 (of which 3553 cast valid votes), turnout - 80.6%.

	PCI-PSI	DC	Miste
votes	1472	1726	355
% of votes	41.4	48.6	10.0
seats	4	16	0

22.11.1964 (Ministero dell'Interno... [etc], 1965)

Electorate - 4791, voters - 3765 (of which 3566 cast valid votes), turnout - 78.6%.

	PCI	PSIUP	PSI	DC	Ind
votes	1080	293	287	1413	493
% of votes	30.3	8.2	8.1	39.6	13.8
seats	6	1	1	9	3

7.6.1970 (Ministero dell'Interno... [etc], 1971)

Electorate - 4723, voters - 3728 (of which 3539 cast valid votes), turnout - 78.9%.

	PCI	PSIUP	PSI	PRI	DC	Eterogenea
votes	1107	135	380	68	1542	307
% of votes	31.3	3.8	10.7	1.9	43.6	8.7
seats	7	0	2	0	10	1

15.6.1975 (Ministero dell'Interno... [etc], 1979a)

Electorate - 5194, voters - 4196 (of which 4006 cast valid votes), turnout - 80.8%.

	PCI	PSI	PSDI	DC	MSI-DN
votes	1309	573	125	1622	377
% of votes	32.7	14.3	3.1	40.5	9.4
seats	7	3	0	8	2

20.6.1976 (Ministero dell'Interno... [etc], 1979b)

Electorate - 5236, voters - 4294 (of which 4149 cast valid votes), turnout - 82.0%.

	PCI	PSI	URSD	DC	MSI-DN
votes	1607	391	71	1686	394
% of votes	38.7	9.4	1.7	40.7	9.5
seats	8	2	0	8	2

24.6.1979 (APM)

No electorate given, voters - 4106 (of which 3961 cast valid votes)

	PCI	PSI	DC	MSI	Lista Civica
votes	904	592	2116	234	115
% of votes	22.8	14.9	53.4	5.9	2.9

26.6.1983 (APM)

Electorate - 5286, voters - 4254 (of which 4013 cast valid votes), turnout - 80.5%.

	PCI	PSI	PSDI	DC	MSI
votes	1167	622	359	1711	154
% of votes	29.0	15.5	8.9	42.6	3.8
seats	6	3	2	9	0

24.6.1984 (APM)

Electorate - 5240, voters - 4112 (of which 3892 cast valid votes), turnout - 78.5%.

	PCI	PSI	PSDI	DC	Lista Civica
votes	1165	669	388	1410	340
% of votes	29.9	17.2	7.9	36.2	8.7
seats	6	3	1	8	2

1989 (interview, Giuseppe Vignola, 22.5.1991)

	PCI	PSI	PSDI	DC
seats	4	3	3	10

F.2 Interviews with the mayors

Four of Grassano's mayors were interviewed for the purposes of this dissertation, using semi-structured interviews:

- Tomasso Celiberti (Christian Democrat mayor from June 1952 to January 1953 and from September 1970 to August 1975) was interviewed on 10.8.1988.
- Gaetano Ambrico (Christian Democrat mayor from October 1958 to November 1960) was interviewed on 11.8.1988.
- Luigi Daraio (Communist mayor from August to September 1975, from August 1976 to December 1977, and from February 1978 to February 1979) was interviewed on 16.8.1988.
- Nicola Vignola [1943-][*] (Christian Democrat mayor from July 1979 to October 1983) was interviewed on 10.8.1988. The questions were designed to establish the perceived role of the mayor and his administration in combating landslides: The questions (translated) were as follows:

1. Were landslides a problem for your administration?
2. What was your administration's strategy for dealing with the landslides?
3. Could you describe for me the help or hindrance your administration received from...
   a. The citizens?
   b. The political parties?
   c. From national and [where appropriate] regional government and government agencies?
   d. From other organizations?
4. Specific questions were then asked about corruption, repair work, or other relevant miscellaneous topics.

* There are two Nicola Vignolas in Grassano politics. The Christian Democrat Nicola Vignola [1943-] is not to be confused with the Democratic Leftist Nicola Vignola [1948-].

F.3 Interviews with the councillors

Semi-structured interviews were also carried out with representatives of four of Grassano's political parties:

- Nicola Vignola [1948-] of the Communist Party - now renamed the Democratic Left Party (PDS), interviewed 10.8.88.
- Giuseppe Vignola of the Socialist Party (PSI), interviewed 16.8.88.
- Domenico Beatrice of the Christian Democrats (DC), interviewed 12.8.88.
- Salvatore Giancursio formerly of the Social Movement (MSI), interviewed 7.8.88.

The questions were designed to provide information on the individual and his party (question 1), and on landslides and politics in Grassano (3 to 5). All the politicians were asked the same questions (with the exception of Domenico Beatrice, who insisted in being given a written question schedule in advance - though did not have time to read it before the interview). For all but Beatrice the questions (translated) were as follows:

1. Why do you belong to your party?
2. How does your party secure support for itself? and for its politics?

   3a. How long have landslides been a problem which involves the administrators of Grassano?

   3b. How important is the problem today?

   4a. What do you believe is the importance the administrators should give to landslides in the future?

   4b. Why after twelve years [since the destruction of the old cemetery] has no new cemetery been built at Grassano?

5. What plans has your party to ensure security from landslides in the future?

For Beatrice the questions (translated) were as follows:

1. Unlike all the other political parties with whom I have already spoken, I have had to give you the questions in advance. Why is this, and with whom must you speak before the interview?
2. How do you ensure support for your party in Grassano, and how do you ensure support for your policies?

3. What is the importance of the influence from organizations outside of politics (the Church, the unions, and soforth) on your party and its politics?
4. How long have landslides been a problem which the political parties have had to deal with at Grassano?
5. What is the significance of this problem today?
6. In your manifesto for the [local] elections of 1979, you explained the importance of a geological report to "give the municipal administration... a means of co-ordinating the consolidation of the town". Have you had success in this co-ordination since '79?
7. Why, after twelve years, is there no new cemetery at Grassano? What are the problems?
8. What projects does your party have to ensure the safety of local people against landslides in the future?

Appendix G: The semi-structured interviews

Forty-four interviewees were interviewed as part of the gathering of oral history of landslides in Grassano. Oral history allows some of the limitations of documentary evidence to be overcome: most importantly in this case where there are only fragmentary documents from the literate (ruling) classes. It can "give back to the people who made and experienced history, through their own words, a central place" (Thompson, 1978, 2).

As Milillo (1983) noted in her work on the oral history of Tricarico, the technique can give what at first appears to be a bewildering variety of information. Oral evidence is subject to collective processes of selection, recording, creativity, and transmission, as even the small matter of the dating of events shows. Evidence becomes part of a social document, the events perceived in the terms of the people who transmit them: it takes on a symbolic character elaborated by the culture of the tellers which can only be interpreted with the understanding of the social processes it reflects - though in this respect it does not differ from other sources of data (Guidoboni, 1987).

Semi-structured interviews have the advantage of providing quotable, colourful material, and of being spontaneous - but they can also be selective, overlong, lack organization, and be difficult to analyze statistically (Lounsbury and Aldrich, 1986). They allow the same in-depth probing of causality as explained in chapter one.

Forty-four semi-structured interviews were conducted with local people in 1988 (1% of the electorate). The interviewees were chosen by random number from the electoral rolls. The 1988 electoral roll contained 5,283 names of whom 2,625 (49.7%) were men and 2,658 (50.3%) were women. This compares to the resident population aged eighteen or over of 4,461 in 1981 - of whom 2,186 (49.0%) were men and 2,275 (51.0%) were women (ISTAT, 1984b).

Finding the subjects proved difficult. Street names were a problem - particularly in the old part of town. Many streets lack name plates. Street names are imposed by the council, and often the local people do not know the street names, or even have their own dialect names. Houses are frequently renumbered by the council without the consent or even the consultation of the residents. Many houses bear a range of numbers: an extreme example of which is that some houses on Corso Umberto Primo have three displayed, none of which are current. Some of the residents interviewed were unaware of their house numbers.

Some felt the questions to be too intrusive, although they may have felt this about any outsider's interest. Mistrust was particularly the case with women. Nine women refused to be interviewed, only two men. The interviews were kept as near to a conversation as possible, and were referred to as "conversations (*"conversazioni"*). The order of the questions tended to come from the flow of the conversation, rather than just punctuate it. Direct quotations were, wherever possible, taken in the original Italian or the local dialect, Grassanese. Summaries were made in English. Two drafts were made of the interview schedules. Five pilot interviews were undertaken on 25 and 26 June 1988.

The subjects were approached directly, though with a neighbour or relative - if neighbour or relative was known. No warning note was delivered - principally because of the gross inaccuracy of the electoral rolls as a guide to who lived where; partly to avoid the problem of alienating illiterates, and partly to avoid the appearance of being too official. Each subject has been given a false first name, chosen at random, to protect the identity of the interviewees. In the text they are referred to as follows:

Andrea was an artizan in his thirties. He was born in Grassano, and had returned to live there continuously since the 1960s. The interview lasted 26 minutes.

Antonio was a pensioner in his seventies. He has always lived in Grassano. The interview lasted 88 minutes.

Arcangelo was an agricultural worker in his sixties. He has always lived in Grassano. The interview lasted 25 minutes.

Bruno was a professional in his thirties. He has always lived in Grassano. The interview lasted 37 minutes.

Domenico was a student in his teens. He has always lived in Grassano. The interview lasted 45 minutes.

Donato was a pensioner in his sixties. He has always lived in Grassano. The interview lasted 44 minutes.

Egridio was a pensioner in his sixties. He has always lived in Grassano. The interview lasted 15 minutes.

Francesco was a pensioner in his seventies. He has always lived in Grassano. The interview lasted 40 minutes.

Giacinto worked in commerce. He was in his sixties. He has always lived in Grassano. The interview lasted 92 minutes.

Giacomo was a pensioner in his eighties. He has always lived in Grassano. The interview lasted 63 minutes. A translator was used, from Grassanese to Italian.

Giovanni was a professional in his thirties. He has always lived in Grassano. The interview lasted 83 minutes.

Giuseppe was an agricultural worker in his fifties. He has always lived in Grassano. The interview lasted 83 minutes.

Innocenzo was a professional in his fifties. He has always lived in Grassano. The interview lasted 30 minutes.

Leonardo worked in commerce. He was in his sixties. He has always lived in Grassano. The interview lasted 44 minutes.

Luigi was a blue collar worker in his fifties. He has always lived in Grassano. The interview lasted 55 minutes.

Marco was a professional in his thirties. He was born in Grassano but lived away from the sixties to the eighties. The interview lasted 49 minutes.

Michele was a pensioner in his seventies. He has lived in Grassano since the forties. The interview lasted 40 minutes.

Nicola worked in commerce. He was in his twenties. He has always lived in Grassano. The interview lasted 46 minutes.

Paolo was a blue collar worker in his forties. He has always lived in Grassano. The interview lasted 44 minutes.

Pasquale was a professional in his twenties. He has always lived in Grassano. The interview lasted 28 minutes.

Pietro was a pensioner in his seventies. He has always lived in Grassano. The interview lasted 23 minutes.

Vincenzo was an agricultural worker in his sixties. He has always lived in Grassano. The interview lasted 64 minutes.

Angela was a housewife in her forties. She has always lived in Grassano. The interview lasted 38 minutes.

Anna was a professional in her twenties. She has always lived in Grassano. The interview lasted 49 minutes.

Antonia was an agricultural worker in her fifties. She has always lived in Grassano. The interview lasted 21 minutes.

Appolonia was a student in her teens. She has always lived in Grassano. The interview lasted 18 minutes.

Beatrice was a pensioner in her sixties. She has always lived in Grassano. The interview lasted 52 minutes.

Carmella was a professional in her twenties. She has always lived in Grassano. The interview lasted 114 minutes.

Caterina was unemployed and in her twenties. She has always lived in Grassano. The interview lasted 38 minutes.

Eufemia was a housewife in her fifties. She has always lived in Grassano. The interview lasted 32 minutes.

Filomena was a housewife in her forties. She has lived in Grassano since the sixties. The interview lasted 44 minutes.

Giovanna was an agricultural worker in her forties. She has always lived in Grassano. The interview lasted 16 minutes.

Giuseppa was a housewife in her twenties. She has always lived in Grassano. The interview lasted 40 minutes.

Isabella was a housewife in her thirties. She lived in Grassano until the 1970s and now visits occasionally. The interview lasted 53 minutes.

Leonarda was a housewife in her forties. She has always lived in Grassano. The interview lasted 25 minutes.

Luisa was a pensioner in her seventies. She has always lived in Grassano. The interview lasted 20 minutes. A translator was used, from Grassanese to Italian.

Maddalena was a housewife in her thirties. She has always lived in Grassano. The interview lasted 33 minutes.

Nicolina was a housewife in her fifties. She has always lived in Grassano. The interview lasted 59 minutes.

Paolina was a professional in her twenties. She has always lived in Grassano. The interview lasted 31 minutes.

Porzia was an agricultural worker in her fifties. She has always lived in Grassano. The interview lasted 60 minutes.

Rosa was a professional in her forties. She has lived in Grassano since the 1970s. The interview lasted 70 minutes.

Santia was a housewife in her sixties. She was born in Grassano but lived away from the 1960s to the 1980s. The interview lasted 51 minutes.

Teresa was a housewife in her forties. She has always lived in Grassano. The interview lasted 63 minutes.

Vittoria was a pensioner in her sixties. She has always lived in Grassano. The interview lasted 40 minutes.

The questions were designed to establish a range of information: background information on the interviewee (questions 1 to 6), an assessment of landslides in Grassano (7 to 10), an assessment of intervention against landslides (11 to 15), an assessment of earthquakes (16 to 19), and impressions about the interview (20-21). The questions (translated) were as follows:

1. [It was explained to the interviewee that they had been chosen at random, that the interview was for a report on landslides in the town, and that their name would be changed to ensure anonymity.]
2. What is your name?
3. What is your date of birth?
4. [If appropriate] Which grade of education did you reach?
5. What is your occupation?
6. How long have you lived in Grassano?
7. Have you ever come across landsliding?
8. Why do you think there are landslides at Grassano?
9. How much of a danger do you think landslides are for Grassano?
10. Do you think they represent a bigger or a smaller danger than in the past?
11. What do you think is the attitude of the political parties towards landslides?
12. What do you think is the attitude of the town hall towards landslides?
13. What do you think is the attitude of the government and the government agencies towards landslides?
14. Do you think enough is being done to prevent landslides?
15. [If appropriate] What do you think should be done to prevent landslides?
16. What were your experiences of the 1980 earthquake?
17. Do you think enough was done after the earthquake to put right the problems?
18. [If appropriate] What were your experiences of the 1930 earthquake?
19. Have you ever heard the suggestion that there is a landslide under the town which moved after the 1980 earthquake?
20. If it's necessary, could I come back to talk to you again?
21. What impressions have you had of our conversations?

The response-codes to questions seven to nineteen were as follows (codes given below):

Questions:	*7*	*8* *	*9*	*10*	*11*	*12*	*13*	*14*	*15**	*16*	*17*	*18*	*19*
Andrea	1	<u>1</u>,2,3	3	3	4	4	4	1	•	3	1	•	2
Antonio	2	3	3	1	4	4	4	3	<u>1</u>, 2	2	1	3	2
Arcangelo	2	2	2	1	4	4	4	2	5	3	2	2	•
Bruno	2	5	2	•	3	3	4	•	•	2	1 *	•	1
Domenico	2,3	2	3	2	4	•	4	3	2, <u>3</u>	3	1 *	•	2
Donato	2	2	3	1	5	•	5	3	2	2	2 *	1	2
Egridio	4	•	•	•	•	•	•	•	•	•	•	•	•
Francesco	1,2	2	2	1	3	•	3	3	1	2	1	3	2
Giacinto	2	<u>1</u>, 2	•	1	5	•	5	3	•	2	•	4	•
Giacomo	2,4	6	3	2	•	•	•	3	•	2	•	3	•
Giovanni	•	1	3	1	5	•	5	3	•	1	1 *	•	2
Giuseppe	1,2	2	3	3	4	3	5	3	1	1	•	•	•
Innocenzo	2,4	<u>1</u>, 5	2	1	2	1	2	1	•	2	2	•	1
Leonardo	1	2	2	1	2	•	2	1	<u>1</u>, 3	3	1	3	2
Luigi	1,2	2	3	1	4	•	3	1	•	3	2	•	2
Marco	2	5	•	•	5	5	5	3	6	1	1	•	1
Michele	1,2,3	1,<u>2</u>	3	1	1	•	2	3	1	3	1	1	2
Nicola	•	<u>1</u>, 2	3	3	5	4	5	•	4	1	2 *	•	2
Paolo	1	<u>1</u>, 2	3	2	5	5	•	3	5	1	2	•	1
Pasquale	2	5	3	•	2	2	3	3	5	1	1	•	1
Pietro	1,3	2	2	1	4	4	•	•	6	2	2	2	•
Vincenzo	1,2	2	3	3	4	4	4	3	2	2	1	3	2
Angela	1,2	1,<u>2</u>	3	•	•	•	4	3	6	3	2	•	2
Anna	1	1	3	2	4	•	4	3	5	1	1	•	2
Antonia	1,2	2	3	1	•	•	2	•	•	2	•	•	•
Appolonia	•	•	1	1	2	•	•	•	•	3	1	•	1
Beatrice	1	2	1	1	2	•	•	1	6	3	1	3	1
Carmella	2	<u>1</u>, 4	3	1	4	4	4	3	3	2	1	•	2
Caterina	1,2,3	<u>2</u>, 4	3	3	5	5	5	3	4	2	1 *	•	2
Eufemia	1,2	•	3	1	•	•	•	1	1	2	1	•	2
Filomena	4	2	3	1	4	•	5	3	1	2	2	•	2
Giovanna	2	2	2	2	•	•	5	1	6	2	1	•	1
Giuseppa	2	1	2	1	2	•	4	1	5	3	1	•	•
Isabella	1,2	<u>1</u>, 4	•	1	2	2	2	3	3	1	2	•	1
Leonarda	1,3	1,<u>2</u>	3	2	5	•	4	2	6	3	1 *	•	2
Luisa	1,4	2,<u>5</u>	3	3	4	•	2	3	<u>2</u>, 3	2	1	1	2
Maddalena	2	2	2	1	2	2	2	3	1	2	2	•	•
Nicolina	2,3	1,<u>2</u>	2	3	•	•	•	3	1	2	1	•	1
Paolina	2	4	3	•	•	•	•	3	3	2	1	•	2
Porzia	2	1,<u>2</u>	3	1	4	•	3	1	•	3	1	•	•
Rosa	2	1	2	3	3	•	4	3	6	2	1	•	•
Santia	1,2,3	<u>1</u>, 3	2	1	4	•	3	1	•	1	1	3	•
Teresa	1,2	1	3	1	2	•	2	1	3	3	1	•	2
Vittoria	2,3,4	2	3	1	3	•	2	3	6	3	1	4	2

* For questions 8 and 15 the first factor named by the respondent, given in underlined typeface, was used for the contingency analysis.

Where the codes indicate references made to the following:

Q7: 1 = the Calvario landslide, 2 = the cemetery landslide, 3 = the Petrino landslide, 4 = other landslides, • = no response.

Q8: 1 = geology, 2 = precipitation or drainage, 3 = relief, 4 = deforestation, 5 = lack of defences, 6 = other, • = no response.

Q9: 1 = none, 2 = moderate, 3 = severe, • = no response.

Q10: 1 = less, 2 = equal, 3 = more, • = no response.

Q11: 1 = very good, 2 = good, 3 = adequate, 4 = poor, 5 = bad, • = no response.

Q12: 1 = very good, 2 = good, 3 = adequate, 4 = poor, 5 = bad, • = no response.

Q13: 1 = very good, 2 = good, 3 = adequate, 4 = poor, 5 = bad, • = no response.

Q14: 1 = yes, 2 = probably, 3 = no, • = no response.

Q15: 1 = retaining structures, 2 = drainage, 3 = reforestation, 4 = planning regulation, 5 = abandonment, 6 = other, • = no response.

Q16: 1 = away from Grassano, 2 = threatening experience, 3 = very threatening experience, • = no response.

Q17: 1 = yes, 2 = no, • = no response, * = problems identified with action.

Q18: 1 = not threatening/does not recall, 2 = unsure, 3 = threatening, 4 = very threatening, • = no response.

Q19: 1 = surprised, 2 = not surprised, • = no response.

For question 7 there were valid responses from 41 interviewees (more than one answer was possible). The response-codes were as follows: modal class = 2; distribution: 1 = 20, 2 = 31, 3 = 8, 4 = 6, • = 3.

For question 8 there were valid responses from 41 interviewees. The response-codes were as follows: modal class = 2; distribution: 1 = 20, 2 = 26, 3 = 3, 4 = 4, 5 = 5, 6 = 1, • = 3.

For question 9 there were valid responses from 40 interviewees. The response-codes were as follows: modal class = 3; distribution: 1 = 2, 2 = 12, 3 = 26, • = 4.

For question 10 there were valid responses from 38 interviewees. The response-codes were as follows: modal class = 1; distribution: 1 = 24, 2 = 6, 3 = 8, • = 6.

For question 11 there were valid responses from 36 interviewees. The response-codes were as follows: modal class = 4; distribution: 1 = 1, 2 = 9, 3 = 4, 4 = 14, 5 = 8, • = 8.

For question 12 there were valid responses from 16 interviewees. The response-codes were as follows: modal class = 4; distribution: 1 = 1, 2 = 3, 3 = 2, 4 = 7, 5 = 3, • = 28.

For question 13 there were valid responses from 35 interviewees. The response-codes were as follows: modal class = 4; distribution: 1 = 0, 2 = 9, 3 = 5, 4 = 12, 5 = 9, • = 9.

For question 14 there were valid responses from 38 interviewees. The response-codes were as follows: modal class = 3; distribution: 1 = 11, 2 = 2, 3 = 25, • = 6.

For question 15 there were valid responses from 32 interviewees (more than one answer was possible). The response-codes were as follows: modal class = 1; distribution: 1 = 9, 2 = 5, 3 = 7, 4 = 2, 5 = 5, 6 = 8, • = 12.

For question 16 there were valid responses from 43 interviewees. The response-codes were as follows: modal class = 2; distribution: 1 = 9, 2 = 20, 3 = 14, • = 1.

For question 17 there were valid responses from 39 interviewees. The response-codes were as follows: modal class = 1; distribution: 1 = 28, 2 = 11, • = 5, * = 7.

For question 18 there were valid responses from 14 interviewees. The response-codes were as follows: modal class = 3; distribution: 1 = 3, 2 = 2, 3 = 7, 4 = 2, • = 30.

For question 19 there were valid responses from 32 interviewees. The response-codes were as follows: modal class = 2; distribution: 1 = 10, 2 = 22, • = 12.

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AMG: Archivio del Municipio di Grassano

APM: Archivio del Prefettorato di Matera

ASM: Archivio di Stato di Matera

ASN: Archivio di Stato di Napoli

ASP: Archivio di Stato di Potenza

AVT: Archivio Vescovile di Tricarico

BCG: Biblioteca Comunale di Grassano

UEM: Ufficio Erediale di Matera

UTANAS: Ufficio Tecnico di ANAS (Potenza)

UTMG: Ufficio Tecnico del Municipio di Grassano

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