An hypothetical nine unit landsurface model

by

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With 1 figure and 9 plates

Introduction

Although much has been written on landsurface morphology, the construction of a detailed landsurface model has apparently not yet been considered. This paper introduces an hypothetical nine unit landsurface model based on field observations made during 1961–65 in the humid temperate northern half of the North Island of New Zealand. The model is defined in terms of surface morphology and contemporary processes, and it provides a technique for the study of landforms which is at once both descriptive and analytical.

The Development of the Nine Unit Landsurface Model

One of the authors (R. J. B.) found that in the Mangakowhiriwhiri catchment[1] nine specific morphological units[2] constantly recurred and that the total landsurface could be described in terms of these nine units. He further found that all nine morphological units rarely occurred on any one slope profile, and that different parts of the catchment could be characterised by the different combinations of the morphologic units occurring in them (BLONG, 1965 a). This work is a logical extension of the techniques established for slope measurement by SAVIGEAR (1952, 1956, 1962) and YOUNG (1963) and for morphological mapping by WATERS (1958), SAVIGEAR (1960), BRIDGES and DOORNKAMP (1963), and

[1] The Mangakowhiriwhiri Stream is a tributary which joins the Waikato River near Mangakino (Grid Ref. N.Z.M.S.I: Sheet N 84 288697), the catchment containing a series of pumice aggradation basins surrounded by outcrops of ignimbrite.

[2] *Morphological unit* is defined in SAVIGEAR (1965, p. 517). The term unit in this paper is similar in meaning to SAVIGEAR's morphological unit but is defined also in terms of process.

CURTIS & al (1965). These techniques have been most recently summarised and extended in SAVIGEAR (1965).

Traditionally the other major alternative approach to landsurface description is concerned more with hillslopes than with the total landsurface. It is probably a fair generalisation to state that most such hillslope models have been based largely on ideas and concepts of hillslope evolution rather than on morphology and an objective interpretation of present day processes. Models that have been described in some detail include the two section model of upper convex slope and lower concave slope of GILBERT (1909, p. 346); the three section or unit model of crest-slope, backslope (mid-slope) and footslope of SAVIGEAR (1960, p. 158) and LEOPOLD & al. (1964, p. 334); the four unit model of waxing slope, free face, constant slope and waning slope of WOOD (1942, pp. 129–31) or with different terms and units as suggested by KING (1953, pp. 728 and 748; 1957, p. 83; 1962, p. 137) and RUHE (1960, p. 165). This is not to say that such authors are exclusively concerned with hillslope evolution, and some attempts have been made to equate specific geomorphic processes with specific slope elements. For example, SCHUMM (1966, p. 102–3) has briefly reviewed some of the factors that may result in the development of convex, concave and straight slope segments on rocks of essentially uniform lithology.

However, none of the previously suggested hillslope models are considered to be sufficiently detailed to permit the meaningful description and interpretation of the total landsurface of the northern half of the North Island. The crest areas from the centres of the interfluves to the tops of the free faces or constant slopes of earlier models were much too generalised for North Auckland landsurfaces, and it was found that three distinct units were necessary to describe and interpret this section of the slope profile. The free face and constant slope, as first described by FISHER (1866), have been retained as the fourth and fifth units in the nine unit model though the concept of a constant slope angle has been rejected in defining unit 5. The pediment or pediment footslope, as defined in the models of King and Ruhe, do not occur in the northern North Island of New Zealand, and has consequently not been considered in the construction of the hypothetical nine unit model. It was found in North Auckland by one of the authors (J. B. D.) that the criteria used in earlier models for differentiating between colluvial and alluvial units were difficult to apply, as intense colluviation has resulted in a supply of colluvial material far exceeding the rate of its removal from the landscape. Most of the lower slopes of valley sides are covered, and many valley bottoms are partially or largely infilled, with colluvial deposits (DALRYMPLE, 1964). This necessitated the recognition of a sixth unit. The alluvial surface, actively built up by fluvial deposition, forms the seventh unit of the model, whilst a further two units were added later – the channel wall and the channel bed – to complete the total landsurface.

The Model Defined

Out of earlier and differing approaches, and based on detailed and reconnaissance field observations throughout the northern half of the North Island, the present hypothetical nine unit landsurface model has gradually emerged as a model based both on form and contemporary geomorphic and pedogenetic processes. In theory this model should be applicable to all landsurfaces occurring in humid temperate environments. The hypothetical nine unit landsurface model is best defined in terms of its component units (Fig. 1).

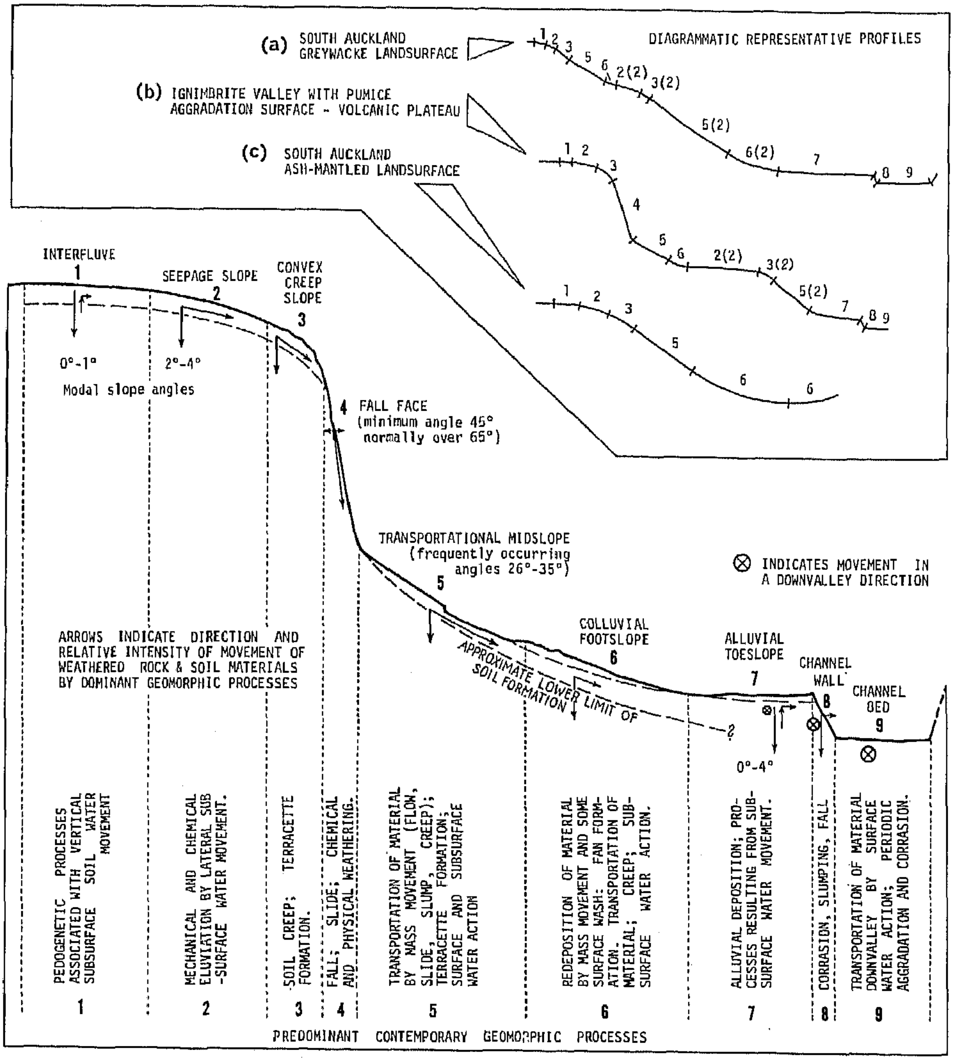

Fig. 1. Diagrammatic representation of the hypothetical nine unit landsurface model

Unit 1: The interfluve

Unit 1 has modal slope angles of zero to one degree and includes the water parting, or divide. It may occupy only the width of a line and seldom extends to any considerable distance. The dominant processes are primarily pedological in nature, being those associated with vertical (both upward and downward) subsurface water movement. Strictly speaking, unit 1 is only half the interfluve, as the profile commences at the 'top of the interfluve' or at the theoretical water parting. Without materially affecting the model however, it is usually more valuable and realistic to consider the interfluve as a whole.

Unit 2: The seepage slope

Unit 2 is an irregular facet[3], but it may steepen towards either end giving an impression of slight convexity. Its modal slope angles are between two and four degrees but may be as steep as about ten degrees, and it is characterised in the field by shallow surface depressions and hollows, by percolines (BUNTING, 1964, p. 73) and piping, and by clumps of rushes (Plates 1 and 11).

Lateral subsurface water movement is the most important geomorphic agent operating on unit 2, giving rise to the dominant processes of lateral mechanical and chemical eluviation (RUXTON, 1958, p. 354). The most lucid statement of the conditions necessary for the development of piping phenomena resulting from mechanical eluviation has been made by FLETCHER & al. (1954, p. 259), and surface features arising from this process have been described from several parts of New Zealand by such workers as Cussen (1888, p. 411), HENDERSON and GRANGE (1926, p. 25), GIBBS (1945), and BLONG (1965 a, pp. 45–53; 1965 b). Chemical eluviation, referring to the lateral and vertical translocation of soil and subsoil material in a soil water solution, has been outlined as an important process in soil and landsurface development in CLAYTON (1956) and BUNTING (1961; 1964; 1965, p. 74). However, chemical eluviation has received little attention in New Zealand literature even though the field evidence indicates that this is a significant and widespread process.

As lateral subsurface water movement is the most important geomorphic agent operating on unit 2, the boundary between units 1 and 2 is defined as the zone where vertical subsurface water movement becomes predominantly (not wholly) lateral in direction.

Unit 3: The convex creep slope

Unit 3 is an irregular slope segment[4] markedly convex in shape. Modal slope angles are of little relevance, but its steepest portion is never greater than 45 degrees. Although these steepest portions are commonly characterised by terracettes[5], creep is considered to be the dominant process (Plates III and IV). In the northern parts of the North Island it is considered that creep results from the

[3] *A facet* is a plane, horizontal, inclined or vertical surface area (SAVIGEAR, 1965, p. 517).

[4] A *segment* is a smoothly curved concave (negative) or convex (positive) upwards surface area (SAVIGEAR, 1965, p. 517).

[5] BLONG (1965) has discussed in some detail the origin of terracettes occurring on unit 3 in the volcanic plateau.

differential wetting and drying of the silt-sized and colloidal clay-sized material of the soil mantle, aided in some areas by the formation of needle ice in A horizons. Such processes are active over practically the whole slope profile, but as these processes are acting under gravitational force, creep is dominant in unit 3 due to the combination of its convex form and location (GILBERT, 1909; SCHUMM, 1956). This unit is thus distinguishable from unit 2 both in terms of shape and dominant process, although the boundary between them is again characteristically a zone.

Unit 4: The fall face

Unit 4 is an irregular facet with a slope not less than 45 degrees, and commonly exceeding 65 degrees. It is characterised by exposure of the parent material and the general absence of soil and vegetation except along planes of weakness and in localised areas of more intensive chemical and physical weathering. Whereas material may slide when disturbed, the dominant process is considered to be fall[6]. There is generally a marked break of slope between units 3 and 4, which accurately demarcates the boundary between them, but of the nine units, unit 4 is that most frequently absent from slope profiles in the northern North Island (Plate V).

Unit 5: The transportational mid-slope

Unit 5 is a facet, usually irregular, with a possible range of slope angles from 45 degrees to less than 20 degrees. In the areas studied in detail, slopes within the range of 26–35 degrees have been observed to occur with remarkable frequency, but the fact that a wide range of slope angles occurs in this unit precludes characterising unit 5 in terms of the concept of constant slope.

Unit 5 is normally the most actively eroding of all units on the slope profile in the northern North Island. Whereas terracettes are common, the frequent occurrence of recent and old mass movement scars testifies that in most cases erosion is caused predominantly by mass movement ranging in speed and type from debris avalanches to slow earth flows with associated slumping (Plate I). The lack of evidence of surface rilling and the lack of bare patches on hillslopes (except where heavily overstocked or already scarred by mass movement) indicate the relative absence of surface water action. Scars are generally of three types: 1. *stretch scars, initiated around the inflection points of units 3 & 5.* These only occur where unit 4 is absent. HADDOCK (1965, pp. 149–51), who has studied these stretch scars in some detail from the hill country of the Onewhero-Raglan area in South Auckland, considers that they develop from tension cracks. The field evidence suggests that these cracks result from differential creep with the thinning or stretching of the soil mantle as the soil material moves under the action of creep from a less steep slope above (unit 3) to a steeper slope below (unit 5). Water is concentrated in the soil by these tension cracks and lateral seepage within the soil profile frequently initiates small-scale flowage. 2. *flow scars, initiated at the head of unit 5.* The flows associated with these scars commonly extend across

[6] Unless otherwise stated, mass movement terminology used in this paper follows that of SHARPE (1938).

Plate I. The foreground comprises a long unit 2, rushes indicating the presense of subsurface drainage. Units 1, 2 and 3 are present on the opposite hillslope, with unit 5 occupying the major portion of the profile. Mass movement scars types (2) and (3) are present. A close correspondence between lines of subsurface drainage and the occurrence of individual mass movement scars is evident. N. Z. M. S. 1: Sheet N 159 Tinui, G. R. 474686. (Photographs by R. J. B. unless otherwise acknowledged).

the entire length of the facet, and they are often associated with the emergence at the head of unit 5 of seepage from units 2 and 3. Saturation of the soil at a point results in flow with some associated slumping at the head. Scar types (1) and (2) both result in emphasising a break of slope between the head of unit 5 and unit 2 or 3, whichever immediately precedes unit 5 (Plates II and III). 3. *flow scars, initiated at the base of unit 5.* These are primarily a result of soil saturation by sapping. The associated slumping at the head of the scar is commonly more extensive than in type (2), and transverse surface cracks frequently extend upslope from the scar. It is important to stress that seepage alone is unlikely to cause these forms of mass movement (Plate VI). Prolonged periods of heavy rain are considered to be the most important necessary condition giving rise to mass movement, while percolines determine their precise location (Plate I).

Unit 5 is characterised by the movement of a large amount of material downslope (relative to other units) by flow, slump, slide, creep, chemical and mechanical eluviation, and to a lesser extent by surface wash. Consequently it is considered

Plate II. Mass movement is extending unit 5 headwards into a predominantly unit 2 profile. Short units 3 are present (fig. 1 (a)). N. Z. M. S. 1: Sheet N 43 Ponui, G. R. 701419. (Photo: R. J. Johns)

that the process most characteristic of unit 5 is the transportation of material downslope.

Where unit 4 occurs above unit 5 in the slope profile, there is generally a marked break of slope between them, and an obvious difference of processes. In those cases where unit 5 is preceded either by unit 2 or unit 3 the break or change of slope is commonly emphasised by the occurrence of stretch or flow scars extending headwards to the boundary of the two units. Again there is a difference of processes. Whereas lateral seepage occurs on all units, and creep occurs on both units 3 and 5, the other forms of mass movement discussed above are initiated on unit 5.

Unit 6: The colluvial footslope

Unit 6 may be regular or irregular, a slope segment or a slope facet. When unit 6 is long it is essentially rectilinear in form, but it may appear in the slope profile as a short concave upwards segment. While material is undoubtedly

Plate III. Some of the complexities introduced by the three-dimensional nature of the landsurface are illustrated here. The major interfluve runs from top right to slightly left of top centre: most of the profile from this interfluve downwards consists of unit 5. However, there are also several secondary interfluves from the foreground (lower right) to the left centre; and in this direction, *across* the major slope profile, there are visible several very short units 1 and 2, well developed units 3, and units 5. Mass movement scars accentuate the transition between units 3 and 5. The scale at which the landsurface is to be studied is of crucial importance. N. Z. M. S. 1: Sheet N 43 Ponui, G. R. 698414.

transported across unit 6, and while creep and lateral seepage are frequently important, unit 6 is essentially the zone of redeposition of colluvial material derived from higher up the slope profile whether by mass movement processes or by surface and subsurface water action (Plates VI and VII).

The junction between unit 6 and whichever unit immediately precedes it on the slope profile is usually smooth. When unit 3 passes straight into unit 6 (a convex-concave form) it can be difficult to determine whether a short unit 5 slope is present (Plate IV). For unit 5 to occur, there must first be a recognisable facet. In theory there will in any event be a facet in the centre of a convex-concave form, but here the question of scale arises and it is necessary for the observer to use his judgement in deciding whether the facet has sufficient length to require recognition. If there is a recognisable facet, but its slope is less than about ten degrees, then the slope in question will probably be a unit 2 slope. This will be

Plate IV. A smooth 2356 profile (fig. 1 (c)). N. Z. M. S. 1: Sheet N 93 Waihaha, G. R. 278597.

confirmed if processes associated with lateral subsurface water movement are dominant. If there are scars, terracettes and other evidence of mass movement on the facet then the dominant process is transportation downslope and it is a unit 5.

Unit 7: The alluvial toeslope

Unit 7 is a facet, frequently irregular, with modal slope angles ranging between zero and four degrees. The dominant process occurring on this unit is the redeposition of alluvial material carried downvalley by the major stream or river (i. e. that stream or river flowing at right angles to the direction of the slope profile). Redeposition need not occur frequently. The slope is still classed as unit 7 provided that the unit has been built up to a discernible depth beneath the surface by material carried by the major stream or river, and provided that it is covered by floodwaters, if only once every fifty years. Unit 7 is thus a flood plain and not a river bed (Plate VI). It differs fundamentally from unit 6 in that material is derived from upvalley rather than from upslope. Should a rill from

Plate V. Units 2 (not easily apparent), 3 (clearly demarcated from unit 4), 5 (with surface irregularities of material fallen from unit 4), and 2 (2). This 2 (2) unit, previously a course of the Waikato river, now has as its dominant processes those associated with lateral subsurface water movement (fig. 1 (b)). N. Z. M. S. 1: Sheet N 66 Matamata, G. R. 176313. (Photo M. J. Selby)

upslope deposit material at the base of unit 5 in the form of an alluvial fan, for example, this would be considered as part of unit 6 (Plate VII).

It is important to point out that the surface irregularities common on units 5, 6 and 7 arise in different ways. On unit 5 irregularities are caused primarily by the initiation of the processes of mass movement, and on unit 6 by the redeposition of such colluvial material. Unit 4 may provide additional material for redeposition on units 5 and 6, while surface and subsurface water movement may also give rise to irregularities. In contrast, surface roughness on unit 7 is primarily the result of abandoned water courses of the main stream or river, and processes associated with subsurface water action.

Where downcutting by the river has occurred, and unit 7 is no longer occasionally covered by floodwaters, such that it has become a river terrace or aggradation surface, then the dominant contemporary process is clearly no longer redeposition of alluvial material. The dominant processes are then either redeposition from the commanding slope, in which event the unit is designated unit 6, or, further out from the commanding slope, the dominant processes are those associated with lateral subsurface water movement, and the unit is designated unit 2 (Plates V and VIII).

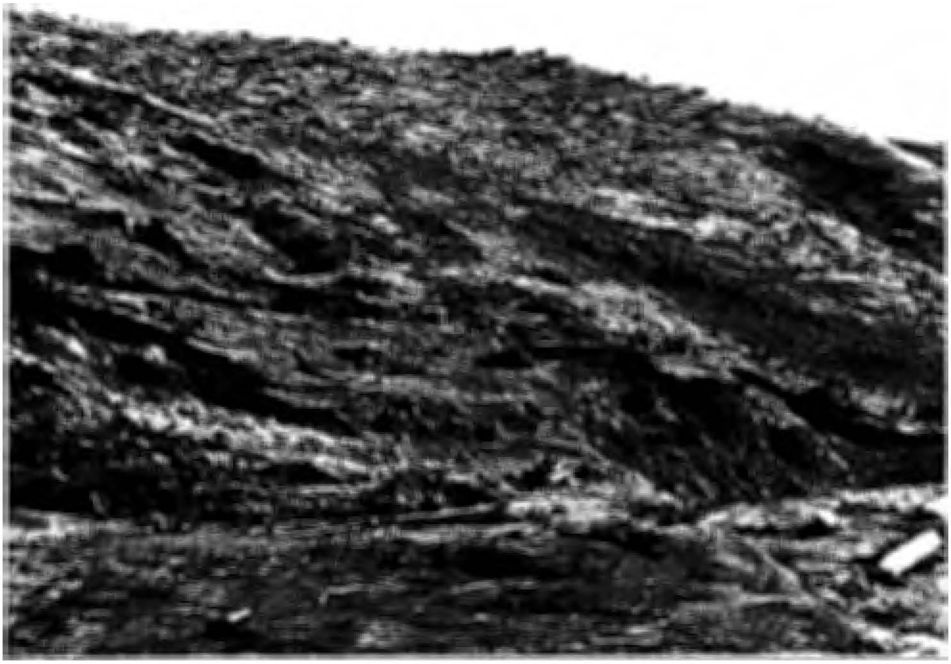

Plate VI. The close relationship between subsurface water movement and the occurrence of mass movement in its more rapid forms is evident here. Those portions of this profile which are still relatively stable are unit 2; the remaining portion where mass movement has and is taking place is unit 5. A slump has occurred at the base of the slope profile to the left of the photograph, and transverse cracks extending headwards are visible. The depositional toe of the earthflow associated with this slump forms a minor unit 6. A small 'flood plain', unit 7, occurs in the left immediate foreground; while to the right is a small unit 8 (channel wall) and a unit 9 (channel bed): (fig. 1 (a)). N. Z. M. S. 1: Sheet N 43 Pōnui, G. R. 705553. (Photo: R. J. Johns)

Unit 8: The channel wall

Unit 8 is the bank of the main river or stream and it extends from the stream bed to 'bankfull stage'. The dominant process is corrasion by the stream: common secondary processes are slumping of the channel wall following the subsiding of floodwaters (TERZAGHI, 1950, pp. 97–100), and fall when the stream is at its 'normal' level. Unit 8 is distinguished from unit 7 by a marked break of slope, and by a difference in processes from redeposition of alluvial material by floodwaters on unit 7 to corrasion on unit 8. Where streams are undergoing rapid downcutting, then that part of the old channel wall above bankfull stage becomes either a unit 4 or a unit 5, depending on its slope angle and dominant contemporary processes (Plate VIII).

Plate VII. An older, more extensive unit 6 (foreground and right), modelled by a combination of redeposition from mass movement and surface water action; and a recent unit 6 (left) resulting from redeposition by mass movement from unit 5 above. Between the unit 6 'tongues' at the base of unit 5 is a minor area of unit 2 (2), where the predominant processes are those associated with subsurface water movement. N. Z. M. S. 1: Sheet N 43 Ponui, G. R. 694415.

Unit 9: The channel bed

As the entire slope profile extends from the top of the interfluve to the thalweg, unit 9 is strictly speaking only half the channel bed. However, in the same way as unit 1 is considered as the total interfluve, it is usually more valuable and realistic to consider the channel bed as a whole.

Whereas at any given time aggradation or corrasion by surface water action may appear to be locally most significant, it is considered that transportation is in general the dominant process characterising unit 9. Although unit 5 is also defined as a 'transportational' slope, the modes and directions of transport are quite distinct. Material is transported across unit 5 *primarily* by processes of colluviation with the main direction of transportation being downslope or at right angles to the major stream or river. In contrast, material is transported along unit 9 by surface water action, in a direction at right angles to the slope profile.

Units 7, 8 and 9 have been distinguished from other units partially in terms of the direction of movement of material across them, and all units are influenced

Plate VIII

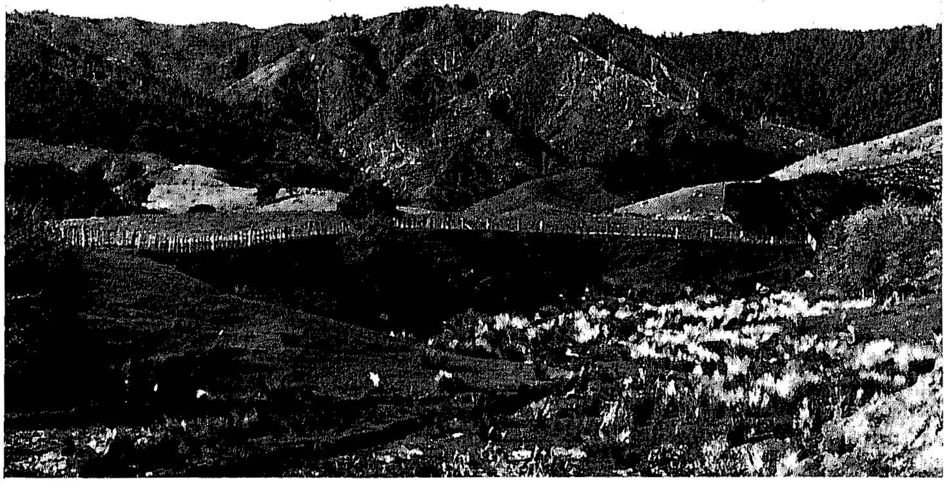

Plate IX

to varying degrees by the redeposition on them of material derived from upslope. However, while the form of the model has been defined in terms of a slope profile, it is a three-dimensional landsurface that is being described. Consequently slope inclinations normally have either downvalley or upvalley as well as cross-profile components, and not all the material moving across any given unit may have come directly from an upslope position, measured at right angles to the downvalley direction.

A particular problem arises with dry, flat-floored valleys, common in the northern North Island of New Zealand, where surface water occurs only during and following high-intensity rainstorms. The problem is whether to term the valley floors unit 7 or unit 9. Particular features of the floors of these valleys include their vegetative covering (usually pasture grasses) and the occurrence of a definite soil. For these reasons they are termed alluvial toeslopes (unit 7) rather than channel beds (unit 9) (Plate IX). The definition of unit 9 in terms of all three processes of corrasion, transportation and aggradation – though transportation is considered dominant – is particularly important in this respect.

Sequence of units

The hypothetical nine unit landsurface model as a whole may now be summarised diagrammatically as shown in Fig. 1. The units are numbered consecutively from the interfluve to the thalweg; and in any one landsurface, only unit 1 must occur, it must be first in the profile, and it must occur only once. The remaining eight units may or may not all be present; they may occur in any order; and they may occur more than once. When a unit occurs only once, its number only is written. When it occurs a second, third or fourth time down a slope, its number is followed immediately by a bracketed numeral indicating the number of times the unit has occurred down the slope profile (e.g. 1, 4, 5, 4 (2), 5 (2), 4 (3), 5 (3), 6, 8, 9 – Fig. I (a), (b) and (c)). In this model the boundary between two units is seldom a sharp break either in terms of form or change in process. However, it is not the identification of unit boundaries, but the recognition of the units themselves which is the prime objective.

Conclusion

Based on observation in the field, the hypothetical nine unit landsurface model provides a framework for the description of form and the contemporary

Plate VIII. The major feature is the 'abandoned' aggradation surface – once a unit 7, now unit 2 (2). This is being modified in places by colluvial redeposition from upslope and headward erosion from downslope (fig. 1 (b)). Below the aggradation surface, the stream is actively downcutting, leaving an extended unit 5 (2) and only a small, clearly defined unit 8 abutting on unit 9. The background landscape is complex, but it exhibits units 1 through to 7 (the dry valley floors). N. Z. M. S. 1: Sheet N 84 Mangakino, G. R. 285673.

Plate IX. Illustrated in the foreground is a dry, flat valley floor defined as unit 7 (being occasionally covered by floodwaters) rather than unit 9 (a channel bed). N. Z. M. S. 1: Sheet N 43 Ponui, G. R. 688435. (Photo: R. J. Johns) processes acting on the total landsurface of the northern half of the North Island of New Zealand on a variety of lithologies, soils and vegetation, a wide range of relative relief and some variations in climate. It differs from earlier models in one or more important respects. The model makes no claim that landforms should take any particular form, or exhibit any tendencies towards any particular profile, but provides a method whereby the actual profile of any landform may be objectively and meaningfully described and its attendant processes examined at a particular level of generalisation. Advantages of the model include its flexibility while retaining specific definitions of each unit, its potential as a tool for mapping and the fact that with further refinement, it lends itself to statistical analysis. Varying combinations of units, precisely measured, can denote slope profile and thus landsurface 'types' which then lend themselves to precise comparison and analysis.

So far this model has only been rigorously tested by means of detailed field measurements in the South Auckland area and on the volcanic plateau. Landsurfaces comprising many variations of the nine units have been described, and the specific *combination* occurring at any one place reflects such factors as differences in lithology from basalt, ignimbrite and greywacke through mudstone, siltstone and sandstone to volcanic ash-fall and pumice deposits and consolidated dune sand; differences in relative relief; minor differences in climate; differences in aspect and other bio-and soil microclimatological conditions; differences in soil morphological characteristics; and differences in land cover from a near approximation to primary bush (podocarp/mixed hardwood forest), to reverted manuka (*Leptospermum* sp.) scrub, and to pastures and ploughed land. This wide range of variants in South Auckland and on the volcanic plateau provided a stringent initial test to the nine unit model; and together with reconnaissance field observations throughout the northern North Island have confirmed that the varying total landsurface in this area may be described in terms of the nine units, and strongly suggest that the dominant processes occurring on each unit are equally characteristic regardless of variations of lithology, soil and vegetation. As yet, however, this suggestion is based solely on observations of the results of inferred processes, and even then largely inferred from surface features. Thus, its verification awaits further detailed research, and consequently the nine unit model described here, whilst based upon observation, is essentially an hypothesis.

Zusammenfassung

Hanguntersuchungen werden hauptsächlich auf zweierlei Art und Weise durchgeführt: einerseits beschäftigen sie sich vornehmlich mit der Messung und Kartierung von Hängen, andererseits betonten sie nachdrücklich die Hangentwicklung mit Hilfe von Denkmodellen. Es ist eine logische Folgerung, aus diesen Methoden Form und Modell gleichgewichtig in einem Modell der Landoberfläche zu vereinigen, das zugleich beschreibend und analysierend ist.

Genaue Messungen in Gebieten von Nord- und Süd-Auckland, auf dem vulkanischen Plateau und Übersichtsbeobachtungen im Gesamtgebiet der nördlichen Hälfte der Nordinsel von Neuseeland ergaben nachdrücklich, daß ein derartiges

Modell in dieser Region anwendbar ist. Das Modell besteht zwischen den Wasserscheiden und dem Flußbett aus neuen Einheiten, die jeweils gleichgewichtig definiert werden mit Begriffen der Form und mit den heutigen Prozessen und somit eine Annäherung zur Beschreibung und Deutung der gesamten Landoberfläche erlauben.

Es wird behauptet, daß sich durch Erweiterungen das Modell in allen gemäßigt humiden Gebieten anwenden läßt.

Die vielen Möglichkeiten und die Anpassungsfähigkeit des Modells der Landoberfläche aus neun Einheiten ergibt für die Kartierung und die statische Analyse einen neuen Ansatz und eine neue Technik.

Résumé

Les études de pentes ont traditionnellement suivi deux voies principales d'approche: celle qui au départ consiste dans la mesure et la cartographie des pentes et celle qui étudie l'évolution des pentes à l'aide de modèles. Une extension logique de ces techniques consiste à combiner l'étude de la forme et des processus et de les introduire avec une importance égale dans un modèle de surface qui serait en conséquence à la fois descriptif et analytique.

Des mesures de terrain détaillées dans les régions du Nord Auckland, du Sud Auckland et sur le plateau volcanique ainsi que des observations de reconnaissance dans la moitié septentrionale de l'île N de Nouvelle Zélande suggère fortement qu'un tel modèle est applicable dans la région. Ce modèle comprend 9 unités, depuis l'interfluve jusqu'au lit d'écoulement, chacune étant définie également en terme de forme et de processus actuels. Ces unités fournissent une approche pour la description et l'interprétation de la surface totale du territoire. Par extension, il est vraisemblable que le modèle peut être applicable dans tous les milieux tempérés humides.

Ce modèle de terrain à 9 unités est une méthode simple, susceptible de fournir des analyses objectives et significatives et pouvant être un instrument pour la cartographie et des analyses statistiques. Il constitue de ce fait une technique de travail géomorphologique pleine de potentialité.

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