

**THREE NEW SETS OF MAPS FOR PAPUA NEW GUINEA:
GEOMORPHOLOGY, VEGETATION, LAND LIMITATION AND
AGRICULTURAL LAND USE POTENTIAL.**

U. SCHWEINFURTH (HEIDELBERG)

Independence of the eastern half of New Guinea, since 1975 known as "Papua New Guinea", prompted during the years just before the event some extraordinary activities by the Australian Administration resp. Its various branches, and as part of it an urge to publish, in considerable contrast to decades of neglect prior to World War II and even for some time afterwards.. (1).

- (1) SCHWEINFURTH, U.: Australien und sein Entwicklungsmodell Ost-Neuguinea. Außenpolitik 1968, 751-760; SCHWEINFURTH, U.: Papua New Guinea - problems of independence. Außenpolitik (Germ. For. Affairs Rev.) 1974, 344-359.

The three map sets under review are part of the publications of C.S.I.R.O., Australia, and are each accompanied by explanatory notes.

Each publication comprises therefore notes and map set, in the scale 1/1 000 000, consisting of four sheets each, cut the same way; the islands of Bougainville and Manus are represented via insets, i.e. not in their true geographical position. Each memoir contains a good number of excellent photographs.

All three publications represent a first attempt at showing the entire eastern half of the island and the smaller islands further east, which are politically included in "Papua New Guinea", with full coverage of the particular topics irrespective of the actual state of knowledge resp. field work. Quite obviously (and stated clearly at least in the first line of the third publication, No.36) a natural resources inventory has been aimed at and the completion of the three map sets plus notes seems to have been scheduled to be carried through by the date of independence. Consequently, a certain pressure of time may have been immanent during the work; to state this impression right

in the beginning is a necessary warning in view of certain weaknesses, which might have been avoided if not for pressure of time under the particular circumstances.

These first map sets of their kind for "Papua New Guinea" have been made possible only by concentrated efforts of the Australian side during the last few years pre-independence. An ambitious goal had been set and there is no doubt, that the maps broaden our knowledge about the eastern half of this tropical island and the islands further east.

I - LÖFFLER, E. : Explanatory notes to the geomorphological map of Papua New Guinea. Land Research Series No.33, C.S.I.R.O., Australia, 1974, 19 pp. 20 ph. (see also: LÖFFLER, E. : The geomorphology of Papua New Guinea, Canberra 1977)

The explanatory notes introduce the reader into the ideas followed in designing the geomorphological map. As the basic material, the various regional studies published within the Land Research Series of C.S.I.R.O. are quoted (2); they cover together about 40% of Papua New Guinea (see sketch map). In addition aerial photography and the evaluation of radar imagery is mentioned. The author himself gained wide field experience in geomorphological research in Papua New Guinea since 1967, when he joined C.S.I.R.O.

- (2) Land Research Series, C.S.I.R.O., Australia :

No.10, 1964: General report on lands of the Buna-Kokoda area, Territory of Papua and New Guinea.

No.12, 1964: General report on lands of the Wanigela-Cape Vogel area, Territory of Papua and New Guinea.

No.14, 1965: Lands of the Port Moresby-Kairuku area, Territory of Papua and New Guinea.

No.15, 1965: General Reports on Lands of the Wabag-Tari area, Territory of Papua and New Guinea.

No.17, 1967: Lands of the Safia-Pongani area, Territory of Papua and New Guinea.

No.20, 1967: Lands of Bougainville and Buka Islands, Territory of Papua and New Guinea.

No.22, 1968: Lands of the Wewak-Lower Sepik area, Territory of Papua and New Guinea.

No.23, 1969: Lands of the Kerema-Vailala area, Territory of Papua and New Guinea.

No.27, 1970: Lands of the Goroka-Mount Hagen area, Papua and New Guinea.

No.29, 1971: Land resources of the Morehead-Kiunga area, Territory of Papua and New Guinea.

No.30, 1972: Lands of the Aitape-Ambunti area, Papua-New Guinea.

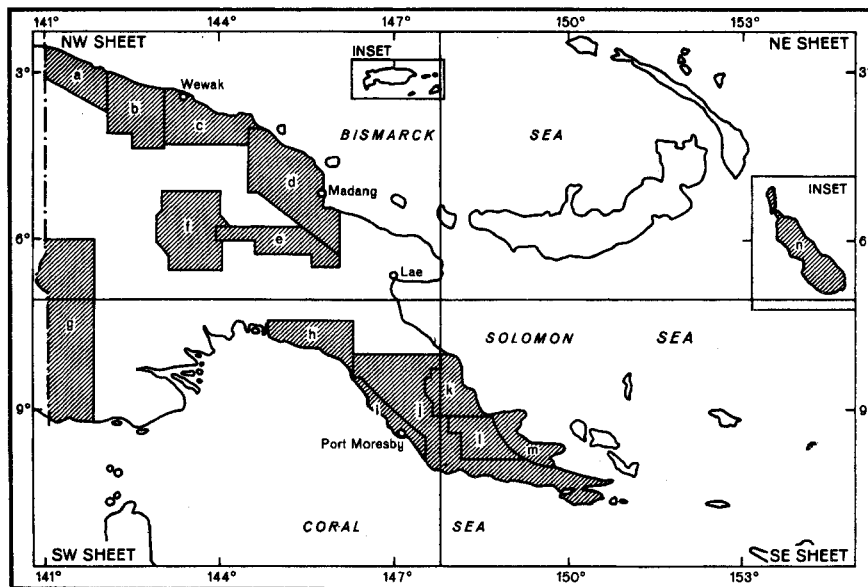
No.31, 1972: Land Resources of the Vanimo area, Papua-New Guinea.

No.32, 1973: Land-form types and vegetation of Eastern Papua.

No.37, 1976: Lands of the Ramu-Madang area, Papua-New Guinea.

The map produced on the geomorphology of Papua New Guinea has to be seen as a compromise for various reasons: the island is tectonically very active and hence distinguished by youthful relief and topography; further, because of the scale allotted to the maps, i.e. 1/1 000 000; and because of the material available. The author freely admits that his own special interests also come into play and, of course, certain considerations in view of potential users: the author imagines all concerned with natural resources and their development and management, planners, engineers, hydrologists, agriculturalists, conservationists. In short, the geomorphological map is largely the result of airphotography interpretation, and therefore a descriptive map of patterns visible on air photographs. Contour lines are not given, nor is topography indicated (topographical maps *sensu stricto* are largely not existing for Papua New Guinea and the islands). There is, however, a sketch map in the memoir which gives four altitudinal zones as a sort of a rough guide line.

On the map and in the notes, the author distinguishes denudational, volcanic, and depositional landforms. Introducing his denudational landforms, he points to the limitations posed by dense forest canopy, refers to karst



Papua New Guinea: sketch map showing delimitation of the four sheets of the three map sets under discussion and areas covered by surveys of Division of Land Use Research, C.S.I.R.O. (see fig.1, Land Res. Ser. No.36, 1975): a) Vanimo; b) Aitape-Ambunti; c) Wewak-Lower Sepik; d) Ramu-Madang; E) Goroka-Mount Hagen; f) Wabag-Tari; g) Morehead-Kiunga; h) Kerema-Vailala; i) Port Moresby-Kairuku; j) Eastern Papua; k) Buna-Kokoda; l) Safia-Pongani; m) Wanigela-Cape Vogel; n) Bougainville and Buka Islands.

landforms so prominent in large parts of the country (see excellent photographs No.4, 5, 7, 8); with reference to landforms of glacial erosion, there are no contemporary glaciers in the eastern half of New Guinea, nor even permanent snow fields, though remnants of former glaciation are well preserved on the various prominent mountains - as, for instance, cirques, moraines, etc. on Mt. Giluwe, Mt. Hagen, Mt. Wilhelm, Mt. Albert Edward, the Saruwaged Range, Mt. Scratchley, and the Kubor Range (ph.9).

Volcanic landforms are abundant in this tectonically active part of the Pacific Rim; they present particularly interesting studies. Mt. Giluwe stands out by an exemplary radial drainage pattern, New Britain by its pumice, etc.

For depositional landforms the main distinction is between fluvial and littoral deposition and both are well represented in Papua New Guinea. The large expanses of amphibious country in the southern coastal plains and in the Sepik plains in the north display excellent examples for meandering, flood plains, and swampy areas. The littoral deposition is exemplified by coral reefs, abounding around most of the coasts of New Guinea and of the islands—the uplifted coral reefs resp. terraces on the Huon Peninsula and New Britain deserve special mention; beach ridges occur in splendid display along most of the southern coast line.

The choice of colours applied suits the purpose: brown-reddish colours for denudational forms, blueish for karst, dark blue for glacial landforms; pink-purple for volcanic forms; green-yellow colours for depositional forms. In addition, letters explain main rock types and raster relief. One can event before making oneself familiar with the legend, easily gain an idea of the basic features of the geomorphology of Papua New Guinea by the colours applied and this is exactly what a map of this type is for. For further insight and intensive studies, there are letters, symbols, rasters providing answers. All in all, this is an excellent geomorphological map of Papua New Guinea.

II - PAIJMANS, K. : Explanatory notes to the vegetation map of Papua New Guinea. Land Research Ser.No.35,C.S.I.R.O. Australia 1975 - 25 pp., 20 pl. with 32 ph. (see also: PAIJMANS, K. (ed): New Guinea Vegetation. Canberra 1976)

The vegetation map is also based mainly on interpretation of air photographs and of the surveys conducted during the past 20 years covering about 40 % of Papua New Guinea (see sketch map). The scale of the air photographs used ranges from 1/20 000 to 1/100 000, the earliest dating from 1943, the most

recent from 1972. The scale of the map is, of course, decisive for what can be shown.

Vegetation is classified under nine major categories, namely forest, woodland, scrub, savanna, grassland, mixed herbaceous vegetation, pioneer vegetation, mangrove vegetation, garden. Further subdivision, for instance for forests, shows 13 subtypes.

The description of the vegetation defines habitat, main areas of occurrence, structure, floristic composition etc. The photographs are good, but give no details of date or, in particular, locality. Like the "explanatory notes" they remain altogether in general terms (just as the volume on New Guinea Vegetation mentioned above). The notes provide mainly a description of types.

The choice of colours on the map seems rather unfortunate. The same colour, only slightly differing in shade, is in many cases used for very different vegetation types, whereas on the other hand, shades of purple, blue, green, olive, orange, brown, all stand for "forest", for instance. Altogether the colour arrangement does not convey an imaginative idea of the overall distribution of the vegetation which, in a way, is the basic idea of such a map (see above for geomorphology). This choice of colours lacks a guiding principle, so important to communicate via colours immediately the right perception as to what the map is all about. There is no explanation given why this unconvincing choice of colours has been arrived at, though the variety of colours available offers all opportunities for a more sensible arrangement, the map maker could hope for. Maps of this kind are, last not least, means of instruction and meant to introduce people, even those not well trained in reading maps, to the variety or, respectively, the apparent order in the variety of the vegetation of a country. The guiding principle should have been to convey at one glance the distribution of forest in contrast to all the other vegetation types.

Furthermore, to indicate the occurrence of two or more vegetation types in a given area by applying schematic stripes (see also statement p.8) dissolves the idea of a vegetation map *sensu stricto* and turns it into a cartogram which is something quite different. This method should be anathema in a map and is to be rejected. For instance, all through the highlands, grassland and garden are indicated in this stripe method, whereas colour for grassland and symbols for gardens should have been quite possible to apply with the airphotographs available and much more satisfactory. Similarly, large parts of the southwest of Papua and the Sepik area in the north are taken out of any map

consideration by the application of the "stripe method".

"A dot symbol indicates old secondary forest and areas of gardens and garden regrowth that are too small or too scattered to be mapped in the garden category" (p.8) - no doubt, a very welcome direction to apply in New Guinea (3)- but there remain questions: what

(3) see for instance: SCHWEINFURTH, U.: Verbreitung und Bedeutung von *Pandanus* sp. in den Hochtälern der Zentralkordillere im östlichen Neuguinea. Coll. Geogr. XII, Bonn 1970, 132-151.

is meant by old secondary forest? And quite obviously the distinction resp. application between dot symbol and garden category is very difficult to comprehend if not explained any further.

To sum up: this vegetation map leaves much to be desired and the way colours and stripes are applied rather spoils what is otherwise good. The only explanation possible for this rather unfortunate result is a deadline for publication and a subsequent rush to get it finished. This explanation, if it is one, does not render the map any more pleasing; it shows, however, very clearly where future work is urgently required.

III - BLEEKER, P.: Explanatory notes to the land limitation and agricultural land use potential map of Papua New Guinea. Land Res. Series No.36, C.S.I.R.O., Australia 1975, 80 pp., 21 ph.

A different set of problems is dealt with in the third map and memoir. Whereas the two maps and notes previously discussed, providing basic material to this third one, are dealing with fundamental issues which to a degree can be deducted directly from airphotographs, the problems discussed and mapped in this third example are rather more of an "applied nature" and certainly more speculative. The notes contain a number of sketch maps in support of the main map and also tables.

It is stated right in the beginning of the notes that "on the eve of independence" the guiding principle was to provide the new nation of Papua New Guinea, the economy of which is basically agricultural, with a general idea about the broad distribution of "land", suitable land that means, and on the other hand, with an overall idea as to the limitations of the land use potential according to certain properties: of terrain, wetness and soils in particular. "It should be seen mainly as a general land inventory, indicating the areas requiring more detailed studies" (p. 5). In addition, the author hopes, his work may serve in the establishment

of national parks, new land settlements and road planning, etc. It seems, this author is more cautious in his approach or more outspoken than the other two. As a matter of fact, his statement applies to the other two sets also, though in varying degree. This statement in any case has to be kept in mind as the most important limiting factor in dealing with this map and memoir.

Further, there are certain basic limitations set by the scale and by the scarcity of information. Taking this into consideration, the resulting map may be even more optimistic than realistic. Again, reference is made to the existing land use research reports (see sketch map and footnote 2), all except one containing data on land use potential. Since not even half of the country is covered by these reports, this again means limitations of a more severe nature and implications in the case of this map than lack of information with reference to some geomorphological or vegetation features.

A factor rating (1-5) is introduced (p.8, table 1) and applied for slope steepness, flooding/inundation hazard, drainage status, drought risk, altitude, surface rocks/stones, fertility, salinity, soil reaction.

A statement like "the 2 400 m (8 000') contour is considered to be the upper growth limit for arable and tree crops" (p.13), is in a country of the topographical variety of the highlands of Papua New Guinea by far too general, even if somewhat balanced by adding "whenever possible, a more detailed breakdown is given..." (4).

(4) see, for instance: SCHWEINFURTH, U.: Pyrethrum cultivation - an attempt at development in the Central Cordillera of Eastern New Guinea. Yearbook, South Asia Institute, Univ. of Heidelberg 1968/1969, Wiesbaden 1969, 117-126; SCHWEINFURTH, U.: Der Teeanbau in Neuguinea. Erdkunde 1970, 220-229; WADDELL, E.: The Mound Builders. Seattle & London 1972.

Map reference starts - sensibly - with the best land and the limitations are marked by capital letters, the lettering starts with "0" for "no limitations"; for rockiness, there are two degrees distinguished (slightly, moderately), for erosion five (minor, moderate, strong, very strong, severe), for drought risk two (minor, moderate), for flooding four (occasional, occasional/irregular, frequent, permanent), for drainage four (imperfectly, poorly, very poorly, swampy). It is, however, rather puzzling how colour is applied. It would have seemed natural, to use one colour for each of these parameters and vary then in strength by shading: the various shades would immediately communicate the idea of various degrees of inten-

sity - symbols could have been added where necessary. The range of colours wanted for such a procedure is there, but there is no guiding principle recognisable nor mentioned in the notes, why the colours have been used the haphazard way they are. Nor can it be said that generally light colours are used for the light and moderate risks resp. limitations and vice-versa.

By way of tables, the distribution of mapping units over administrative districts is listed. Considering the very frequent statements in the text of "no information available" etc. the limits of this sort of information are only too obvious. Likewise it seems to be not much more than a rather academic study to interpolate - based upon such information - the suitability of land for arable crops, tree crops, improved pastures, flooded rice etc. An appendix provides "ecological aspects" of some crops grown in Papua New Guinea (p.78-80). The list of references is not satisfactory.

To sum up: this treatise - and consequently the map - are as heavily loaded with limitations, as the basic material is limited and loaded with question marks. This has to be kept in mind, when studying the map. Criticism as to the use of colour is certainly warranted; the opportunities offered could have been put to better use. It remains, however, to state, that this map is a first attempt, an experiment. It shows in very general terms the situation of limitations to land use and the limitations of agricultural land use potential, whatever the shortcomings may be.

It is made quite clear in this last memoir of "Explanatory notes": the publication of the three sets of maps and the accompanying memoirs was scheduled to be ready for the independence of the country (1975). They were meant as a present to the new nation, as a summing up documentation by the Australian Administration on their eve of departure. The efforts, heavily subsidised during the later part of Australian Administration, had to show visible results: maps and in particular coloured ones have their appeal. The explanatory notes with their abundance of technical jargon make for tiring reading, but they are in many ways indispensable. Finally, the uncertainty whether field work in Papua New Guinea would at all be possible after independence, may have enhanced the decision to have these maps published by all means. This politically motivated situation may have put the three authors under pressure. Accordingly, certain aspects do not display the stage of maturity one would otherwise have expected from expensive productions like these. The obvious solution, to leave unexplored areas white, blank, though academically preferable, may have

had no appeal under the given, less academically than politically motivated circumstances, to which the temptations of the availability of airphotographs these days have to be added.

In the present reviewer's opinion, the geomorphological map is the best performed of the three; perhaps, it was altogether in a more advanced state as the date of publication (1974) seems to indicate. Also, airphotography offers the best and most undisputable base material for geomorphological data and interpretations and compared with the other two, geomorphology, perhaps, suffers less by the scale 1/1 000 000 or rather overcomes limitations connected with this scale easier.

Vegetation is a different matter altogether. The idea of showing on the map large parts of the country in a stripe method, displays a basic lack of concept and cannot be tolerated, as it strikes at the root of the matter. It would have been preferable, to leave the parts covered with stripes simply blank or, instead, use colour plus symbols. The choice of colours, so lavishly available, shows lack of concept how to display the results - all in all: a missed opportunity, when once abundant funds seemed to have been available as the range of colours betrays. This vegetation map reflects a lack of the all important regional approach, as evident in the text and in the captions to the otherwise excellent photographs (similar criticism applies to the volume on Papua New Guinea Vegetation mentioned above).

It is perhaps appropriate in this context to direct interest to the vegetation map of Eastern Papua (accompanying Land Res. Ser. No.32, 1973) published in 1/1 000 000 as well; this representation avoids the "stripe method" and though it does not use the colour range available to full advantage, it creates all in all a much more favourable impression; likewise the map of the forest resources of the Ramu-Madang area (Land Res. Ser. No.37, 1976), admittedly on the more forthcoming scale 1/500 000, shows altogether a much sounder approach and correspondingly achieves immediately a highly informative effect.

The map of the limitation of land use is compared with the other two - the most difficult, methodologically. Whereas geomorphology and vegetation can derive a lot of their basic data and material directly from airphotographs, as the stated basic material of all three map sets, this is not possible in such a direct way for the map of land use limitations. This last map set is by nature somewhat more hypothetical than the other two. Again, one has to ask: why not make better use of the means offered? Why not have one colour for each of the relevant parameters and differentiate them by shades? It

would help to comprehend the map. There is a basic lack in the art of map making apparent.

To sum up: three sets of maps in 1/1 000 000 for the eastern half of New Guinea and the islands further east, resp. for Papua New Guinea have been published by C.S.I.R.O., Canberra, Australia in 1974 and 1975. For the first time, they present a better than just very general idea of geomorphology vegetation, and land limitations of the country. All three published at the eve of independence of the country, represent, in a way, a concluding effort by the Australian Administration resp. C.S.I.R.O. to their land research activities.

Where these efforts for the one or the other reason seem less perfect, they may be accepted as to point very

directly to where future research must start. The order of the day is now and for a long time to come for much more detailed work; the great danger inherent in complete looking productions is to convey the idea that all "obviously" is reasonably well-known. Not every map user will go into the trouble to read the accompanying notes. But be that as it may, a certain framework has been established and is offered and where it is not altogether successful, it will stimulate discussion and criticism, and will, where necessary, in due course lead to improvement and here and there to the application of other, better methods. The three map sets, therefore, may - besides being a guideline for the new state - be regarded as an invitation to future research in a country, the exciting possibilities of which the three maps make abundantly clear.

Südasiens Institut der Universität Heidelberg
Institut für Geographie
Postfach 103066
69 HEIDELBERG (Allemagne)