World Land Use Survey = L'utilisation du sol dans le monde

INTERNATIONAL GEOGRAPHICAL UNION

WORLD LAND USE SURVEY
L' UTILISATION DU SOL DANS LE MONDE

Report of the Commission to the General Assembly of the IGU
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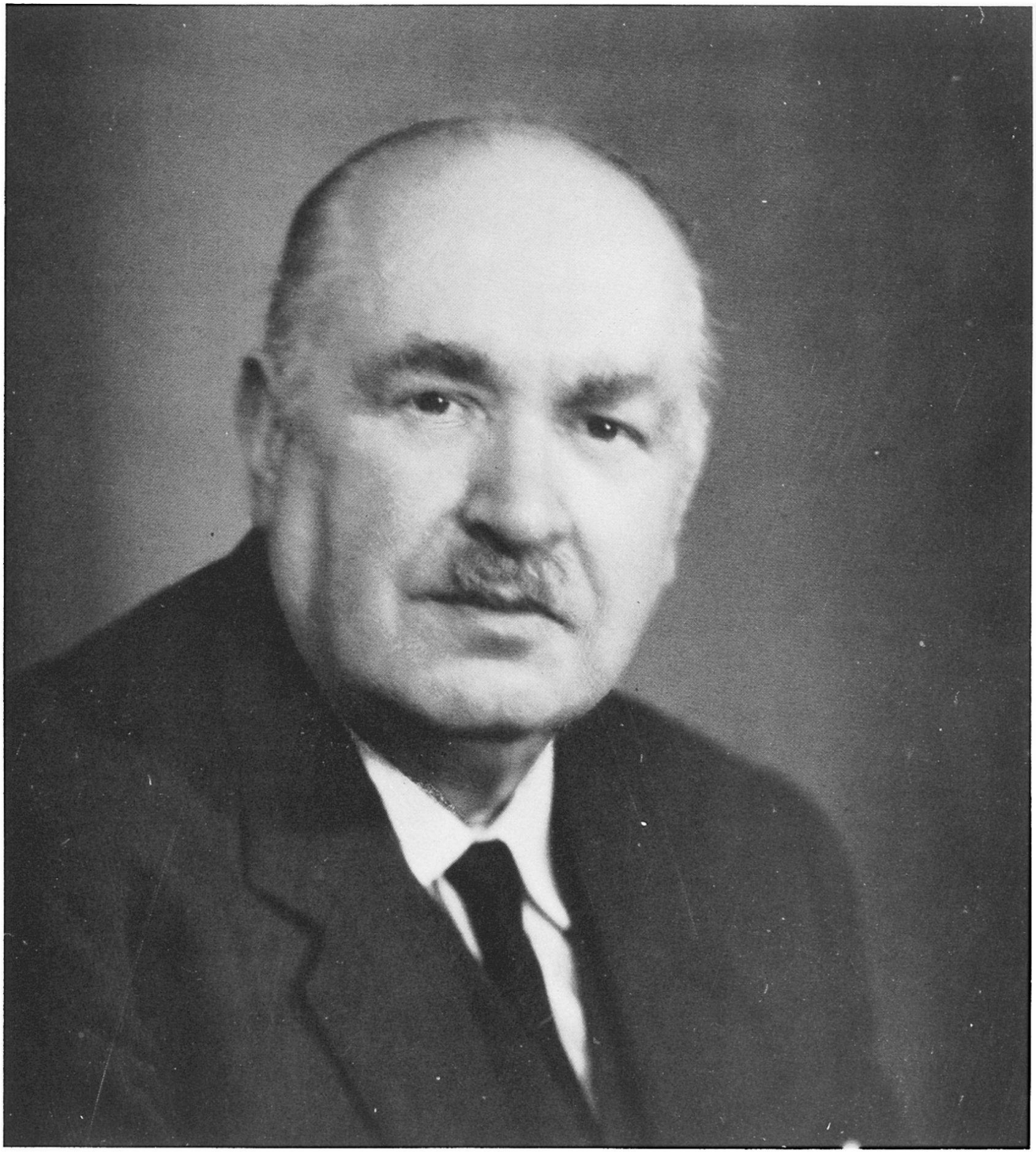
Seperate prints of this report, were sent to the General Assembly of the International Geographical Union, Moskwa 1976, for distribution, as well as to the subscribers of the World Land Use Survey.



Professor L. Dudley Stamp

WORLD LAND USE SURVEY COMMISSION

H. Boesch

Land use mapping has been for a long time an activity carried out by geographers. In a uniform manner and on a nation-wide scale, a survey was organized by L. D. STAMP in the early thirties in Great Britain. S. VAN VALKENBURG proposed in 1949 at the International Geographical Congress in Lisboa, that the IGU should create a commission to discuss the possibility of a world-wide survey on a scale of 1:1 Million. The original members of that commission were: S. VAN VALKENBURG (Chairman), L. D. STAMP, P. GOUROU, L. WAIBEL, and H. BOESCH. This Commission started immediately to work and with generous help from UNESCO a meeting was held from April 8-16, 1949, at Clark University in Worcester, Massachusetts, USA. The main item on the agenda was the establishing of land use categories, suitable for all parts of the world. The legend was set up with the help of a great many consultants and experts.

The General Assemblies of the IGU reappointed the Commission without changing its name period after period. But there were minor changes in the terms of reference. The most important related to membership. At the International Geographical Congress 1956 (Rio de Janeiro) L. D. STAMP took ovér the chairmanship, and H. BOESCH, H. GAUSSEN, J. KOSTROWICKI, and S. VAN VALKENBURG were appointed as members. At the Stockholm meeting in 1960 R. HO replaced H. GAUSSEN. The London General Assembly in 1964 reappointed L. D. STAMP as chairman; members were R. HO, J. KOSTROWICKI, S. VAN VALKENBURG, A. WATANABE, M. A. GLAUOVSKAYA. After the untimely death of L. D. STAMP in 1966 the Executive Committee appointed H. BOESCH as chairman ad int. After 1968(New Delhi) the Commission continued in the following composition: H. BOESCH (Chairman), E. CZATI, P. FLATRES, R. C. HODGES, J. KOSTROWICKI, and A. WATANABE. Since 1972 (Montreal) its membership has been: H. BOESCH (Chairman), E. CZATI, P. FLATRES, R. C. HODGES (in 1974 replaced by P. B. CLIBBON), CH. T. N. PALUDAN, and M. TAKASAKI.

This Commission has had a long life. The members have repeatedly asked for radical changes, either by discontinuing the Commission altogether or by altering the terms of reference and designation. The longevity is primarily due to the interests represented by various National Committees. They pointed out that at a time when national surveys were being discussed all around the world, a discontinuation of this Commission could be interpreted as a lack of interest in land use surveys as such and prove harmful for this sector of applied geography.

The members of the Commission were well aware of the fact that its functions had changed, and that the name "World Land Use Survey" was no longer in accordance with the actual work. The original idea of 1949, to establish a survey on a 1:1 Million scale, was soon abandoned. National surveys needed much larger scales. The Commission acted during this period (i. e., after the completion of its first and second report and after a classification had been set up and the principles had been laid down) more in an advisory capacity to various bodies undertaking land use surveys; and as a clearing house for relevant information. This may look like a simple task, but it did bear fruit and land use surveys were soon being carried out in many parts of the world with the active cooperation of the Commission.

In the meantime new techniques had become available and new problems assumed a prominent place. Land use surveys were no more a simple mapping of what was grown, in accordance with pre-established categories. Among the new techniques were the modern information systems, data recording and data retrieving. Others were in the field of data capturing and the rapid progress made in remote sensing. Also the new possiblities of data output in graphic form opened new avenues and needed investigation. The production pattern of the traditional land use map remained important, but the organizational patterns and land-ownership could no longer be neglected. More and more the geographer, with better background knowledge, hat to listen to the politician, who cared more about potentialities than realities. The Commission has never neglected these challenges and most fruitful meetings were held, where new techniques and the scope of future work were discussed. With the generous

help of the SHELL Company a meeting attended by many experts was held in London from April 21-23, 1970, where new possibilities and techniques for land use and related surveys were discussed. This was being followed up by a publication in the series THE WORLD LAND USE SURVEY":CONTRIBUTIONS TO LAND USE SURVEY METHODS, 1971.

Most geographers are well aware of these changes and many of them take an active part in the research relevant to them. For a commission of the IGU certain conditions have to be fulfilled if it is to operate sucessfully in such a field. Research in new techniques and possibilities of land use surveying demands considerable expenditure on equipment of all kinds. Members should, therefore, be selected from those who have ready access to such expensive equipment. If commission members do not have considerable facilities for their work, the commission will be unable to operate successfully. It should also be borne in mind that an exchange of information is fruitful only if it takes place in direct conversation and discussion. Members should, consequently, also come from institutions which make travel to such meetings financially possible, because the IGU will be less and less able to contribute towards expenses.

The Commission in its present composition fulfills the requirements mentioned above only in part. In 1972 the members were unanimously of the opinion that this shouls be the last period of life for the World Land Use Survey Commission, and that after 1976 the General Assembly it would either have to discontinue such activities or find a more suitable solution. However, in the meantime, opinion has become divided on that subject. It remains to be seen what the next General Assembly will decide in Moskwa.

However, whatever decision is taken, there is no doubt that land use surveys will develop technically in every respect and become of growing importance in any information system. The question is what attitude the IGU will take when it comes to appointing commissions, working groups, etc.; and whether or not such bodies are really operative, unhampered by insufficient funds and inadequate membership.

L. D. STAMP was the great organizer in the life of the Commission. Besides his many other contributions, he initiated the World Land Use Survey Series published by Geographic Publications Ltd. Mrs. AUDREY CLARK will report on this facet in a seperate chapter. It was never directly a publication of the Commission and the IGU had no obligations of any sort. Still, it was one of the many happy creations, so typical of the late L. D. STAMP, which served a number of people and organizations, and which were financially taken care of by only one of them.

S. VAN VALKENBURG was the initiator. He had more than the usual dose of idealism and conceived the World Land Use Survey primarily as one of the means to better the future of mankind. He and L. D. STAMP, in many ways complementary, were great friends.

In this short report, the acting regular members try to outline certain avenues for future activities. Originally, it was planned to include also a survey of land use surveys undertaken in the different parts of the world. This soon proved to be an impossible task, because the idea of land use surveys has spread and been accepted in so many countries. The published material is now so enormous, that to record it would have taken all our time and more than the funds at our disposal.

Bibliography

(a) older Reports etc. are out of print and in most cases unobtainable.

(b) the IGU-Bulletin has regularly reported on the activities of the Commission. It also contains the Reports which were submitted to each General Assembly of the IGU.

(c) in the International Yearbook of Cartography, VIII, 1968 an article is to be found by Hans H. Boesch: The World Land Use Survey (p. 136-143), which contains numerous references to earlier reports, some of them in manuscript form. This source should be available in most geography departments.

LES CARTES D' UTILISATION DU SOL EN EUROPE OCCIDENTALE: L' EXEMPLE DE LA FRANCE

P. Flatres

INTRODUCTION:

Les pays de l'Europe occidentale présentent des contrastes étonnants pour les réalisations des cartes d'utilisation du sol. L'exemple de ces réalisations a été donné par le Grande-Bretagne qui, par l'initiative et grace aux efforts de J. DUDLEY STAMP a été entièrement recouverte par le premier "Land utilisation survey", à grande échelle (1:63360), lancée dans les années 30, oeuvre considérable dont l'intérêt pratique pour la politique agricole a aussitôt été démontrée au cours des années de guerre. Le second "Land utilisation survey", à une échelle encore plus grande (1:25000) est, comme on le sait, activement poursuivi sous la direction de Miss COLEMAN.

L'Italie a été, dans le domaine de la cartographie de l'utilisation du sol, un digne émule de la Grande-Bretagne. Ses cartes de l'utilisation agricole du sol suivent les principes posés en Grande-Bretagne, quoique avec une échelle plus petite (1:250000) et avec une légende adaptée aux types d'agriculture méditerranéens.

L'achèvement de cette grande oeuvre, avec les feuilles couvrant la Sardaigne, a été annoncé au Congrès de Montréal en 1972.

En revanche, les autres pays ont très inégalement abordé l'oeuvre de cartographie de l'utilisation du sol.

Le Portugal, à peu près seul, a entrepris une série cartographique régulière à grande échelle (1:50000), fort intéressante car adaptée aux types d'agriculture et de silviculture lusitaniens; et suivant aussi dans l'ensemble les principes de la cartographie britannique.

Dans d'autres pays, par exemple la Belgique, le Luxembourg, aucune publication à grande échelle n'a eu lieu.

En Allemagne, des pages fort précises ont été publiées dans le "Atlas der Deutschen Agrarlandschaft". Elles suivent les principes britanniques, elles aussi, et, plus précisément s'apparentent à celles du second "Land utilisation survey", avec peut-être plus de précision concernant les formations naturelles (forêts, marais, tourbières). De plus, de nombreuses cartes de l'affectation des sols urbains ou périurbains à très grande échelle (1:5000) ont été publiées par les divers organismes d'aménagement des Länder et des villes. (1)

Ces attitudes très diverses, en des pays voisins, où la tradition cartographique est ancienne et précise, posent des questions délicates pour lesquelles l'exemple de la France, pays où les réalisations multiples sont restées modestes, permettra peut-être de donner des éléments de réponse. Nous allons examiner les efforts accomplis, ou simplement tentés en ce sens, selon les institutions et les organismes qui en ont été responsables. Ce plan, inhabituel, montrera cependant mieux qu'un simple catalogue chronologique, ou qu'un examen thématique, les motivations et les préoccupations de la cartographie de l'utilisation du sol en France, l'originalité et aussi les limitations de l'effort réalisé.

LES TRAVAUX UNIVERSITAIRES.

La parution des cartes du premier Land Utilization Survey britannique a suscité un vif intérêt chez certains géographes français, notamment chez ceux qui avaient des préoccupations de géographie appliquée ou d'aménagement. Cet intérêt a été relayé ensuite par des préoccupations d'ordre typologique (pour l'étude de certaines agricultures extérieures à la zone tempérée) et par le souci d'intégrer de nouveaux facteurs à une cartographie exclusivement aréale. Cet intérêt pour les travaux de cartographie de l'utilisation du sol est allé croissant et se diversifiant ces dernières années. Un indice de l'actualité de ce genre d'études est la thèse de troisième cycle de Mlle Michèle SACHET sur la "Cartographie de l'utilisation du sol, problèmes de méthodes, problèmes d'échelle", soutenue à l'Université de Paris I le 20 juin 1975. (2)

TRAVAUX DU PROFESSEUR PERPILLOU.(3)

Et pourtant, les travaux les plus anciennement entrepris, les seuls qui aient réussi à couvrir la France entière, ne sont pas d'inspiration directement britannique. Ce sont les cartes établies et publiées sous la direction de PERPILLOU (1952-1970). Elles diffèrent en effet des cartes du LUS britannique, et des cartes entreprises ensuite en divers pays sous l'inspiration de la Commission de l'utilisation du sol de l'UGI par plusieurs caractères: par l'échelle,

qui est petite (1:400000 en échelles voisine, pour les cartes départementales, 1:1400000 pour la carte de la France entière), par la source documentaire, qui est purement statistique (superficie, dans chaque commune, des principales "natures de culture", d'après les documents cadastraux), et par la mise en oeuvre que la nature de la documentation entraine (système de bandes verticales de couleur et de largeur variables, calculé de façon à montrer l'écart entre la répartition des natures de culture dans une commune donnée et la répartition moyenne sur l'ensemble du territoire). Le procédé est très expressif, et il permet des comparaisons cartographiques dans le temps (premiers cadastres du 19ème siècle, début du 20ème, époque actuelle).

TRAVAUX RELATIFS A DES REGIONS NON-FRANCAISES (4)

Plusieurs géographes français ont essayé de cartographier, à plus ou moins grande échelle, les régions non-françaises où ils effectuaient leurs recherches. M. DOIN, pour un secteur d'Andalousie, a essayé d'intégrer à sa carte des éléments des structures d'exploitation. Pour le Sénégal on a établi une carte à petite échelle (1:100000), par photointerprétation, intéressante par le mode de représentation de l'intensité et de l'emprise spatiale variable des cultures tropicales à jachères (système de bandes diagonales plus ou moins larges et espacées, contrastant avec les teintes plates et les signes ponctuels réservés aux cas exceptionnels de cultures continues). En plusieurs pays africains, d'autre part, des géographes et agronomes de l'ORSTOM (5) travaillent à des cartes à moyenne et grande échelle (1:100000 et 1:50000). Pour le Cameroun, plusieurs feuilles sont déjà prêtes, notamment pour des régions du Sud-Ouest du pays.

LES CARTES DE ROTATIONS AGRICOLES (6)

Le professeur KOSTROWICKI, dans ses cartes d'utilisation du sol de la Pologne, a été le premier à introduire la représentation des rotations agricoles (par des semis de groupes de points, chaque groupe comportant autant de points qu'il y a d'années dans la rotation; un petit cercle symbolise, lorsqu'elle existe, l'année de jachère).
Ces préoccupations n'ont jusqu'ici trouvé d'écho que dans deux ou trois Instituts de géographie français: Paris (Mme BONNAMOUR), Lille (M. FLATRES puis M. VAUDOIS), et Rennes (M. FLATRES).
Mme BONNAMOUR, travaillant sur une commune de "grande agriculture" de la région parisienne, a pu représenter les successions culturelles par des bandes de lettres initiales de chaque culture, lettres colorées selon les groupes de plantes cultivées.
M. FLATRES, travaillant dans une région d'agriculture intensive compliquée en petites parcelles, a proposé un système de représentation en faisceaux de traits verticaux correspondant à la durée du rythme de base, avec tout un système de "brisures" indiquant les anomalies intervenant dans la succession réelle constatée des cultures. L'échelle est en principe le 1:10000, et le travail se fait dans le cadre communal. Le but serait de produire un échantillonnage de cartes communales typiques des diverses régions agricoles. Jusqu'ici, seule une carte, a été imprimée.
Toujours dans le Nord de la France, M. VAUDOIS a perfectionné la méthode pour la représentation des successions maraîchères, qui comportent d'une part une extrême variété de produits, d'autre part des doubles ou même des triples cultures dans l'année.
Au Canada, dans la province de Québec, la regrettée Madame BOUDEWEEL-LEFEBVRE avait adapté la méthode à la représentation des rotations culturales, dans le cadre des "rangs" canadiens.
A Paris, Mlle SACHET, dans sa thèse récente, profitant des nouveaux relevés annuels culturaux réalisés par le Ministère de l'Agriculture aux mêmes points d'échantillonnage, a proposé une méthode neuve de représentation des "taux de stabilité" des différentes cultures. Etant donnée la source documentaire (échantillonnage statistique), la représentation cartographique ne peut être réalisée que dans un cadre départemental.

INCLUSION DES STRUCTURES SOCIO-ECONOMIQUES

Le professeur PIERRE BRUNET, de Caen, a

lancé un travail cartographique à grande échelle (1:50000) pour lequel la feuille de Mézidon, en Normandie, a paru en 1973. (7) L'originalité de cette carte est sa préoccupation de la représentation de nombreuses variétés de la "végétation naturelle" (elle a été réalisée en collaboration avec des botanistes), et de la représentation des structures socio-économiques d'exploitation (localisation des sièges d'exploitation par des symboles indiquant la catégorie de taille des exploitations). Elle a été réalisée par photointerprétation et enquêtes sur le terrain.

INCLUSION DE FAITS D'ENVIRONNEMENT. (8)

Le souci actuel de la "qualité de la vie", et la préoccupation de la pollution ont été à l'origine de travaux récents, commencés indépendamment en plusieurs Universités, mais qui se regroupent actuellement au sein d'un groupe de travail du Comité national de géographie présidé par le Professeur JOURNAUX. Le but essentiel de ces cartes n'est pas, comme pour celles que nous avons examinées jusqu'ici, la représentation des faits agricoles; cependant comme elles cartographient aussi un espace agricole et forestier, elles doivent être mentionnées.
Une première carte de la région de Saint-Etienne (une feuille au 1:100000) a été réalisée à l'Université de cette ville par une équipe dirigée par le Professeur BETHEMONT. Elle indique à la fois les éléments attractifs (forêts, plans d'eau, perlouses montagnardes), neutres (espaces cultivés) et répulsifs (terrils, usines polluantes).
Une série de cartes, avec une légende plus compliquée a été entrepris à Caen par le Professeur JOURNAUX, et doit être reprise par plusieurs autres universités, de sorte qu'elle couvrira sans doute assez rapidement une partie notable du territoire. L'échelle est le 1:50000; la légende, essentiellement "environnementaliste" est très riche et très précise. En revanche, la représentation de l'occupation non-industrielle du sol est simplifiée.
Telles sont les principales voies qu'a empruntées la recherche cartographique universitaire en France. On pourrait mentionner encore plusieurs autres orientations. Par exemple, Mlle SACHET a proposé dans sa thèse un mode de représentation à petite ou moyenne échelle qui combine la représentation aréale exacte et statistique, un peu à la manière de l'EULUSMAP dirigée par le Dr. CSATI.
Ces efforts, en des sens très divers, plus ou moins réussis, plus ou moins poussés, révèlent des préoccupations très vives dans le domaine de la cartographie de l'utilisation du sol, des initiatives très intéressantes, une ouverture qui pourrait être féconde dans sa dispersion même, au moins au stade de la recherche conceptuelle. Cependant, jusqu'ici, à part les cartes de PERPILLOU et sans doute celles de JOURNAUX, les réalisations sont restées ponctuelles, et les Universités n'ont pas été à l'origine d'une grande oeuvre d'échelle nationale comme celle du LUS britannique. Un fait qui doit porter à réfléchir est la préoccupation de plus en plus grande de certains aspects thématiques (structures socio-économiques, environnement) aux dépens des aspects purement agricoles. L'époque des grandes cartes de l'utilisation du sol agricole serait elle passée? Et la France l'aurait-elle laissée passer sans réaliser une oeuvre semblable à celle qu'ont accomplie au moins deux pays voisins? Il n'y a sans doute pas lieu d'être pessimiste: une réponse encourageante peut venir de l'Institut géographique national. (IGN)

L'INSTITUT GEOGRAPHIQUE NATIONAL

L'IGN, organisme d'Etat chargé de la cartographie, dispose de moyens techniques modernes que ne possèdent pas les Universités, et c'est en grande partie pour cela que la recherche universitaire tend à abandonner les types de représentation fondés sur la photoanalyse, comme le sont tous les procédés modernes de représentation de l'utilisation du sol agricole. Or l'IGN a récemment mis au point et donné les premiers exemples de trois séries de cartes dites " de la végétation et des cultures" ou de l'occupation du sol, qui se rapprochent beaucoup des cartes inspirées par la Commission d'utilisation du sol de l'UGI. Une originalité est qu'elles sont accompagnées de cartes de l'équipement (eau, électricité, gaz....), à moins que des signes représentant l'équipement ne figurent sur la carte même de la végétation et des cultures. Mais jusqu'ici, l'IGN, qui a mis au moins les méthodes de photoanalyse, et les procédés de

représentation cartographiques en couleur, ne travaille qu'à la demande, sur commandes financées par divers organismes publics ou parapublics, de sorte que les cartes réalisées jusqu'ici ne sont que, soit des prototypes, soit des cartes locales ou de petites séries exécutées à l'occasion d'actions d'aménagement du territoire.

Après avoir réalisé en 1966 une carte au 1:10000 (Bazas, arrondissement de Langon, Gironde), l'IGN semble avoir choisi trois niveaux d'échelles: 1:5000, 1: 20000 ou 1: 25000 et 1:100000.

Le 1:5000 est l'échelle des plans cadastraux modernes, et les cartes à cette échelle sont liées à des opérations d'aménagement périurbain. Elles ont pour but, notamment, de fixer avec le maximum de précision les cultures ou types de cultures pratiquées sur chaque parcelle, afin de faciliter les opérations d'expropriation éventuelles. C'est pourquoi l'IGN parle, à leur propos, d'"Inventaires des cultures et de la végétation". C'est dire qu'elles ne peuvent être que d'intérêt local ou momentané. En revanche, au point de vue méthodologique, ce sont les cartes qui ont nécessité l'emploi des techniques les plus poussées de photographie aérienne, et les méthodes de photoanalyse les plus fines. Après des cartes de la région de Pontoise, liées à la création de la ville nouvelle de Cergy-Pontoise, et commissionnées par la Préfecture de la Région parisienne (Maurecourt, VII 18 SE, Courdimanche, VII 18 SO, Cergy, VII 18 SE) réalisées en 1966-1967, a été effectuée une carte de l'agglomération bordelaise (1974). La légende des premières comporte les indications suivantes: grandes cultures (céréales, légumineuses); plantes sarclées non-fourragères; cultures légumières de plein champ; cultures maraîchères et florales; pépinières; vergers et arbres fruitiers; vergers organisés (avec surcharges pour les framboisiers et les groseilliers); vignes; serres fixes; prés et prairies permanentes; landes et friches; bois (distinction des taillis et fûtaies); plantations. La légende de la carte bordelaise, de préoccupation surtout urbaine, distingue, sous le titre "agriculture" sept ou huit catégories: cultures diverses annuelles; prairie, prés permanents; friches, terres improductives ou abandonnées; maraîchage; vergers; vignes; forêt; roche à nu, carrière:, etc.

Le 1:25000 n'est représenté jusqu'ici que par une carte: la région de Bazas (Gironde) (cantons de Accros, Bazas, Grignols plus une commune du canton de Langon). Bien que la carte ne porte pas le fond parcellaire, elle indique l'extension précise des différents modes d'utilisation du sol. La légende comporte: cultures diverses; vignes; vergers; parcellaire cultural morcelé et joualles (les joualles sont dans le Midi des rangées de cep de vignes intercalées au milieu d'autres cultures); prés permanents; bois; plantations, friches. Les couleurs (jaune pour les cultures, violet pour les cultures arbustives, vert clair pour les prés, vert foncé pour les bois), se rapprochent beaucoup des couleurs utilisées par les LUS britanniques.

Le 1:100000 n'est lui non plus représenté jusqu'à présent que par une carte, celle de Langon. Des pourparlers ont eu lieu pour l'extension de cette cartographie aux deux départements du Nord de la France, mais jusqu'ici ils n'ont pas abouti. Les principes de cette carte sont les mêmes que ceux de la carte au 1:25000, avec évidemment un degré plus grand de généralisation. Elle devrait devenir la carte standard de l'utilisation du sol de la France.

Dans l'ensemble, les principes généraux de la cartographie de l'utilisation du sol, ou, comme l'indique le titre de la carte de Langon, de l'occupation du sol, est bien exprimée par l'IGN dans la note d'information du juin 1970 présentant la carte au 1:25000:"Dans cette carte, les formations végétales naturelles ou remaniées et les cultures pratiquées par l'homme sont classées en grandes catégories, en fonction de critères choisis précisément en vue de l'aménagement. Parmi ces critères interviennent la nature de l'occupation humaine, son degré d'intensité, d'efficacité, de capacité de production. Conçue de cette façon, la carte exprime dans leurs grandes lignes les structures agraires, et conduit à une première approche de la valeur foncière du terrain. Le classement des formations végétales retenues n'est prisonnier d'aucun systématisme; il est défini dans chaque région en fonction des caractères morphologiques, climatiques, phytogéographiques de la région

et des particularités de l'action humaine. "

MINISTERES TECHNIQUES ET ADMINISTRATIONS.

Si les travaux généraux de l'IGN n'ont pas davantage suscité de commanditaires, c'est sans doute parce que plusieurs administrations centrales ou locales ont préféré développer leurs propres lignes de recherche, en vue d'objectifs précis ou pour résoudre des problèmes circonstanciels. Parfois d'ailleurs, ces travaux sont techniquement aidés ou matériellement réalisés pa l'IGN et, en certains cas, la part respective des différents organismes est difficile à saisir.

LE MINISTERE DE L'AGRICULTURE

Le Ministère de l'Agriculture a une action cartographique notable soit par sa Section technique centrale de l'aménagement foncier et des structures, (STCAFS), soit par certaines de ses Directions Départementales de l'Agriculture (DDA). Parmi ces dernières trois exemples peuvent être retenus.
La DDA de Charente Maritime a fait exécuter en 1969 une carte de l'utilisation du sol de l'Ile de Ré au 1:10000.
La DDA de la Gironde a réalisé une carte des Landes de Gascogne au 1:20000 en trois couleurs, carte dont l'objectif est essentiellement la protection contre les incendies de forêts. Aussi les équipements, notamment en ce qui concerne l'eau y sont-ils portés avec une grande précision. La légende distingue neuf catégories de boisement, et seulement trois catégories autres (landes et friches; vignes vergers et cultures; prés). Sont parues en carte les feuilles Audenge 7-8, Pessac 5-6. Les feuilles de Audenge 5-6, Pessac 7, Belin 1-2-3-4, et Langon 1 sont sous forme de photos surchargées.
La DDA du Finistère participe à des travaux de pointe sur la cartographie des paysages (valeur quantifiée de l'élément "variété") et la cartographie automatique de l'utilisation du sol. Elle vient de sortir deux feuilles donnant au 1:10000, par signes correspondant à des ponts espacés de 50 m, la "Carte statistique d'occupation des sols de la commune de Pont-de-Buis-lès-Quimerch". La légende distingue notamment les fûtais mixtes; les taillis et aillis sous fûtaies; le reboisement, le territoire forestier non-boisé; les surfaces arbustives; les cultures annuelles; les prairies artificielles et prairies régulièrement entretenues; les jardins privatifs; les prairies permanentes; les prairies permanentes mouilleuses; les prés-vergers; les landes et friches nues; les landes mouilleuses.
Cette carte est un exemple des recherches menées par différents organismes du Ministère de l'Agriculture sur la cartographie automatique de l'utilisation du sol. Jusqu'ici la photoanalyse a été faite humainement, mais on essaie de la réaliser automatiquement.

LE MINISTERE DE LA PROTECTION DE LA NATURE ET DE L'ENVIRONNEMENT.

Ce ministère a fait réaliser d'assez nombreuses cartes paysagères ou de sites, qui ne rentrent pas dans le cadre de cette étude. En revanche une carte "de l'utilisation du sol" du Marais Poitevin au 1:100000 soit être mentionnée. Elle a été réalisée en 1974, et la légende indique, en une suite inhabituelle des éléments très divers (cultures annuelles; prairies et prés permanents; communaux; vignes et vergers; cultures maraîchères; bois non différenciés; marais mouillé à boisement dense; marais mouillé à boisement lâche; bocage hors-marais; habitats; prés-salés - (schorres) ; vases non-consolidées (slikke); plages de sables et galets ; platiers rocheux; mytiliculture; ostréiculture; zone d'occupation mixte, 1) habitat en forêt, 2) cultures et vignes; occupation ponctuelle, 1) vignes, 2) maraîchage).

AUTRES ORGANISMES.

Enfin, il faut rappeler que nombre d'organismes régionaux ont fait réaliser des cartes des agglomérations ou zones urbaines. La plupart se limitent aux indications purement urbanistiques, mais elles sont fort importantes pour les études d'utilisation du sol urbain.

CONCLUSION

Le tableau qui vient d'être tracé n'est pas sans poser de problèmes. Pourquoi cette multiplici-

té d'approches? Pourquoi a-t'on attendu si longtemps pour proposer des formules de cartographie de l'utilisation du sol utilisables à l'échelle du pays? Pourquoi, une fois que ces formules ont été proposées et rendues opérationnelles, les instances de décision font-elles preuve de tant de prudence pour une généralisation?
Le progrès des techniques et l'accélération de ce progrès, l'urgence de certaines études compliquent certes la situation; mais ce pourrait être aussi bien une raison de réaliser vite des cartes souhaitables.
Les changements d'affectation des sols, liés à la "mutation agricoleé, au remembrement, à l'urbanisation, d'une part provoquent des études limitées à certaines localités névralgiques, mais aussi, d'autre part, tempèrent l'ardeur de certains pour une cartographie générale qui serait, dit-on, périmée avant même d'être terminée.
L'on peut penser cependant qu'une cartographie générale à une échelle moyenne ou grande (1:1000000 ou 1:500000) serait d'abord un instrument de connaissance qui fait encore défaut, ensuite un modèle à partir duquel on pourrait mesurer, à l'occasion de relevés rapides successifs, l'extension, la traduction spatiale de cette mutation même dont tout le monde a conscience mais que l'on peut si difficilement mesurer.

THE RECENT TENDENCY OF THE LAND USE SURVEY AND ITS BACKGROUND IN JAPAN

M. Takasaki

1. HISTORY OF THE LAND USE SURVEY IN JAPAN

It was after World War II that the production of the land use map was commenced on a full scale in Japan. After the war, it was most urgent that the Japanese nation should increase food production to make good the serious shortages, to secure basic natural resources, and to rehabilitate and develop the destroyed motherland. For these purposes, special acts were enacted, such as the Multipurpose Land Development Act, and those of National Planning and Regional Planning. The National Comprehensive Development Plan and some other large scale development project were also set up. To carry out these National and Regional Plans it was indispensable that we should have accurate knowledge about the land as it was, and the state of its use.

Under these circumstances, the GSI (Geographical Survey Institute) began to produce land use maps at the request of the ministries and agencies which were associated with National and Regional Planning. In 1951 the ministries and agencies related to planning (such as the Ministry of Construction, the Ministry of Agriculture and Forestry, the Forestry Agency, the Ministry of Transport, Statistics Bureau of the Prime Minister's Office, the Geological Survey Institute, the Public Utility Commission, the GSI) assembled and discussed the contents of the land use map and drew up the manual of land use surveying. According to that manual, land use survey has been carried out mainly by the staff of GSI since 1953, and now the land use map covers 200,000 km2.

This land use map is one of the most systematic among the thematic maps in Japan. Most of the land use maps produced before were drawn on the scale of 1:50'000, and based on the topographic maps which covered the whole country on the same scale. Since 1967, the land use maps have been available for the public as well as the governmental use.

Recently, some local government authorities have produced land use maps for their own purposes on various scales, and most of these maps are made under the advice and instruction of GSI. Their classification is more or less the same as that of GSI.

After the war, the production of the land use map on the scale of 1:50'000 was promoted by the government as basic material for National and Regional Planning. Since then the classification has changed gradually with the change of time.

At the time when the land use survey was inaugurated the classification employed in the legends of the land use map was based mainly on agricultural land use. Recently, however, the detailed classification used is based on the function of urban communities. These changes in the legends show clearly that the emphasis has shifted from the time when the production of food was all-important to the time when urban problems, caused by the population pressure in built up areas, by the increased production of industry and by pollution, were the overriding consideration.

Since 1964, a nation-wide project of making the topographic map on the scale of 1:25'000 has been promoted, and its completion is close at hand. Therefore the new topographic map on the scale of 1:25'000 is almost ready as the new basic map, which takes the place of the former map on the scale of 1:50'000. As far as the land use map is concerned, it should be scaled-up to 1:25'000. The scaled-up map makes it possible to express functions of urban area in more detail.

The problem now under investigation is how to increase the efficiency of the work of the land use map production, simultaneously with the work of the revision survey of the topographic map. In the Third 10-Year Basic survey Plan, it is clearly noted that a nation-wide land use map on the scale of 1:25'000 should be prepared.

2. ENACTMENT OF NATIONAL LAND USE PLANNING ACT

The rapid growth of the Japanese economy after World War II brought about considerable confusion in national land use pattern. Under the highly advanced structure of industrial business, many industries and people centred very rapidly on big cities. In these over-populated areas such serious problems arise as deterioration of environmental conditions, housing problems, traffic problems and a dreadful rise in price of land.

In the rural district, on the other hand, due to the out-flow of the young generation, the average age of inhabitants becomes greater and the development of agriculture and forestry becomes weaker. This brings about problems as to how to make effective use of, and how to preserve, farm and forest.
To solve these problems the following items should be considered in national land use planning for the future.
(1) To re-examine the reasonable way of land use in order to meet the need of various uses (such as forestal, agricultural, industrial and housing).
(2) To promote the decentralization of industry and population at present centred on big cities, and to maintain a better living environment there.
(3) To construct all facilities of local cities and rural communities.
To meet these needs, the National Land Use Planning Act was enacted in June, 1974. The Act declares that with the limited natural resources, public welfare should be given the highest priority; the preservation of the natural environment should be taken into consideration; the healthy cultural living environment should be secured; and the well-balanced development of the national land shoul be promoted.
Under this Act, the Japanese government is due to build up a new National Plan in co-operation with local governments, and is now taking steps to implement the plan. This plan is prepared as a blueprint of desirable land use in 1985. Within the scope of this plan, urban and rural prefectures, and cities, towns and villages are due to make their own regional plans, if necessary. Each prefecture is also due to make a basic land use plan of its own region and to classify it into the following five areas:
(1) Urban Area
(2) Rural Area
(3) Forest Area
(4) National Park Area
(5) Conservation Area
With the enactment of the National Land Use Planning Act, a new agency, The National Land Agency, was set up to enforce the Act, and to make plans and adjustments of land use.

3. NATIONAL LAND INFORMATION SERVICE

The National Land Agency decided to establish the system of the National Land Information Service which will supply data necessary for the national and regional land use plans which are to be drawn up by the government and urban and rural prefectures under the provisions of the National Land Use Planning Act.
GSI will execute three basic parts of the total system such as aerial photographing in natural colour, the production of the land use map and the digitizing of national land information. Aerial photographing in natural colour, the first link in the chain of the National Land Information Service system, was started in the fiscal year 1974.
During the 1974 fiscal year, about 79'100km2 of land was covered by the natural colour aerial photographs and in the 1975 fiscal year an area of 72'500 Km2 will be photographed. The scale of photographs is 1:8'000 for the flat terrain, 1:10'000 for the hilly terrain and 1:15'000 for the mountainous area.
The whole area of Japan has been repeatedly photographed in black and white by the Geographical Survey Institute and by the Forest Agency. However, this is the first time that the whole country will be covered by natural colour aerial photographs: it is an epochmaking event in the history of surveying in Japan.
The production of the land use map will start in the 1975 fiscal year. It will cover the main habitable areas of the whole nation, especially the flat land and adjoining areas, which covers about 90'000km2. In the 1975 fiscal year, the land use map of 18'000km2 area will be completed. The scale of the map will be 1:25'000, the same as that used in the land use map planned in the Third 10-Year Project of Basic Survey. The contents to be examined will be the same as well.
To produce the land use map, natural colour aerial photographs are used. It is, however, desirable that the information from the aerial photographs should be new and fresh enough. Therefore the production of the land use map should immediately follow the photographing. The land use map produced in this way will, together with the topographic map, play a very important role in the regional planning. They are used as

THE CLASSIFICATION OF THE 1 : 25'000 LAND USE MAP	
City and Village	Farm
General Residential District Multi-floor Residential District General Shopping District Business District Industrial District Area Embracing Residential, Business and Industrial District Government and Local Public Agency School District District for Welfare Facilities Park and Green Zone Facilities for Sports Transportation and Distribution District District for Supply and Processing Defense Force Establishment	Paddy Field Upland Field Orchard Mulberry Field Tea Plantation Other Tree Plantation Pasture Land Forest Broadleaf Forest Coniferous Forest Bamboo Forest Palmaceous Forest Mixed Forest Land Creeping Pine Grove Dwarf Bamboo Thicket Waste Land

the basis for digitizing national land information at the same time.
The aim of digitizing national land information is to complete the comprehensive data necessary for the assessment of national and regional plans by analysis and simulation with a computer. For this purpose, the whole country is divided into 400'000 standard mesh of about 1Km x 1Km. National land information is digitized using the standard mesh as a unit, and stored on magnetic tapes forming the data bank. The number of items in the stored land information will be around 90, including land use, topography, geology, vegetation and climate etc.. In the 1975 fiscal year, 7 items will be digitized.

4. THE CONTENTS OF THE 1:25'000 LAND USE MAP

The 1:25'000 land use map, which forms a link in the chain of the national land information system project, should be kept in step with the 1:25'000 topographic map which was used as the base map of the land use map. Since the revision survey of the topographic map and the revision survey of the land use map have many points in common, both surveys can be accomplished effectively if they are carried out together. For this reason, almost all legends of the topographic map are adjusted to the classification of the land use map.
First of all, the land use pattern is classified into the following three main categories: (1) town and village area, (2) farm area and (3) forest area, corresponding to the urban area, rural area and forest area of the basic land use plan mentioned in chapter 2.
The town and village area is subdivided into 10 area items and 4 public service items according to their functions. Because these public service items are related to the zonal area of the City Planning Act, an area on the land use map can be compared with that of the city plan.
The farm area is subdivided into 7 items and the forest area is subdivided into 8 items according to their vegetation cover.
The classification of the land use map is shown in the previous table.
In the legends, the reddish colour is used for town and village area, the yellowish for farm area, and the greenish for forest area.

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LAND USE SURVEYS BASED ON REMOTE SENSING FROM HIGH ALTITUDES

C. T. Paludan

Just three weeks prior to the meeting of the Commission of World Land Use Survey, International Geographical Union, in Montreal, August 1972, the first satellite dedicated to earth resources surveys was launched. This was LANDSAT-1. Of the many uses made of LANDSAT data, no aspect has been more prominent than that of land-use survey. If the aspect of agricultural inventory is included, it is no exaggeration to say that no problem within the field of geography was in more need of LANDSAT-type data than the discipline of land-use survey. The predictions voiced in Montreal in 1972 have become reality a thousand days later: world land-use survey at a uniform scale and with compatible classifications is within our grasp.

HIGH ALTITUDE REMOTE SENSING

The term, high altitude, usually encompasses the region above 12 kilometers. Remote sensing from this distance can be accomplished by jet aircraft, balloons, ballistic rockets, and satellites. Commercial photogrammetric service is offered in many parts of the world using executive-type jet aircraft operating at altitudes in the range of 12 to 14 kilometers. Higher altitude sensing is available only through government agencies at this time, due to the present lack of commercial availability of high performance aircraft such as the RB-57F, the U-2, the Tupolev TU-144, and the Concorde, and the high cost of operation - which exceeds $1'000(U.S.) per hour. The U.S. National Aeronautics and Space Administration operates RB-57F's and U-2's for remote sensing purposes at nominal altitudes of 17 to 20 kilometers, and makes the data available at the cost of reproduction through the U.S. Department of the Interior. A typical image from 18.3 km altitude covers an area 28 by 28 km on the ground or 784 square kilometers. The cost of a color copy in transparency form is $12(U.S.) or about $0.015 per square kilometer. Unfortunately only a few areas have been covered with such imagery, and operation costs are likely to continue to make this mode of data collection generally unavailable.

Free balloons, the original source of the first aerial photography more than a hundred years ago, are capable of remote sensing from high altitudes. On November 3, 1971, for example, a balloon launched by the Centre National d'Etudes Spatiales photographed nearly 5'500 square Kilometers - 1 per cent of French territory - from an altitude of 32 kilometers (Girard-Ganneau, 1974, pp. 1467-1474). The cost of thematic maps from that flight was about $1.00 per square kilometer, including balloon cost ($1'000) and interpretation costs. The area observed by such a balloon is determined by the launch site and the wind direction at the cruise altitude - factors which may be too restrective for some projects.

A relatively inexpensive system for remote sensing from ballistic rockets has been developed by the British Aircraft Corporation and the Royal Aircraft Establishment in the United Kingdom, and has been applied to land-use survey in Argentina (DRENNAN, et al., 1974, pp. 1475-1496). Preliminary analysis indicated a cost for land-use survey by rockets would be between $1.19 and $2.62 per square kilometer. In this case, the availability of data would be dependent upon a sponsor to pay the cost of the operation, and the permission of national authorities for the slight risk of damage when the components return to earth.

Of all modes for high altitude remote sensing, the only one available for inexpensive worldwide coverage is the satellite. This coverage began with automated satellites dedicated to meterological investigations in 1960. In 1965, a panel sponsored by the U.S. National Academy of Sciences stated:"Land use and field morphology, more than any other aspect of rural settlement, may be the phenomena most effectively imaged by space-borne sensors."

A world land-use survey. At the earliest possible moment, an attempt should be made to conduct a comprehensive survey of world land use. (National Academy of Sciences, 1965, pp. 73, 75.)

On July 23, 1972, the National Aeronautics and Space Administration orbited LANDSAT-1 (LANDSAT was formerly named "ERTS," for Earth Resources Technology Satellite. The name was changed in January 1975.) This satellite was designed specifically for earth resources survey on a global basis. It was followed on January 22, 1975, by LANDSAT-2.

The manned orbital SKYLAB missions of 1973 and 1974 also provided earth resource data of large areas.

CLASSIFICATION SYSTEM

The World Land Use Survey Commission established a classification system in 1949 which contained nine categories (Geographical Journal, 1950, pp. 225-226). This was later referred to as a "master key" (IGU, 1952, p. 8), with the idea that it would be a uniform system throughout the world, including even the color code. This intention was restated in 1965 by SIR DUDLEY STAMP: " The aim .... was and is to encourage all countries of the world to make their results comparable. A cardinal rule is that countries shall not combine any of the major world categories but may make as many subdivisions as local circumstances may require or render desirable"(STAMP, 1965).
As noted by KOSTROWICKI, this rule has not been universally obeyed (KOSTROWICKI, 1970, p. 74). Many land-use surveys have ignored the 1949 WLUS system completely, with the result that comparisons are difficult. In the United States an elaborate coding system was published as a national standard with nine categories almost completely unlike the WLUS categories. It was urban oriented, with all non-urban lumped into a single category of "resource production and extraction. " What an ironic revenge for the WLUS system's single category for all "settlements and associated non-agricultural lands! " (Urban Renewal Administration, 1965). A review of U. S. classifications was published in 1965 (CLAWSON and STEWART, 1965).
During a three year period prior to the LANDSAT launch (1969-1971), a study of land-use classification was made by the Commission on Geographic Applications of Remote Sensing of the Association of American Geographers (AAG). The results were published in April 1971 (ANDERSON, 1971, pp. 379-387). In June of that year, a "Conference on Land Use Information and Classification" was held in Washington, D. C. under the joint sponsorship of NASA and the U. S. Department of the Interior. An Inter-Agency Steering Committee of a number of U. S. agencies was established under the chairmanship of GERLACH until his untimely death in May 1972, and subsequently under ANDERSON (Inter-Agency Steering Committee, 1972). The WLUS system was one of several considered by the conference, others being the AAG proposal, the Urban Renewal System, the Canadian system, and the New York State system. The meeting was astoundingly successful, considering the participation of 155 persons of widely divergent interests. The results were published as a Geological Survey Circular in 1972 to permit wider dissemination and discussion (ANDERSON, et. al., 1972). It is still evolving, but the latest version is shown in Table I. While every category of the 1949 WLUS system is represented, STAMP'S "cardinal rule" is broken in two cases: pasture and cropland are combined and horticulture is combined with tree and other perennial crops. At the time, it was felt that remotely sensed data would be unable to distinguish these categories.
The proposed classification is hierarchical, with the intention that Level I would be used for small scale data (such as that from LANDSAT) and small scale maps, while Level II assumes larger scale data and maps. It is important to note that the system was deliverately compromised to apply to remotely-sensed data. This kind of limitation was previously recognized by a paragraph in KOSTROWICKI's paper, but his objections applied to conventional aerial photographs, not to multispectral images with their greater information content. (KOSTROWICKI, 1970, p. 73). The color code was adopted directly from the WLUS system. Further refinements in the classification system will probably be directed toward problems of automatic recognition of land-use categories by computer programs.

LANDSAT PRODUCTS

Imagery suitable for land-use surveys is produced by two instruments on each of the two LANDSAT satellites currently in orbit. These are the Return Beam Vidicon (RBV) and the Multispectral Scanner (MSS). Both instruments are multispectral in nature -- they produce three or four images of the same scene, each of a different portion of the electromagnetic spectrum. The spectrum extends into the near

TABLE I LAND-USE CLASSIFICATION SYSTEM FOR REMOTELY SENSED DATA

Level I	Level II	Alphabetical Code	Color Code
1. Urban and Built-up Land	11. Residential	Ur	Red
	12. Commercial and Services	Uc	
	13. Industrial	Ui	
	14. Transportation, Communications, and Utilities	Ut	
	15. Industrial and Commercial Complexes	Uic	
	16. Mixed	Um	
	17. Other	Uo	
2. Agricultural Land	21. Cropland and Pasture	Ac	Light
	22. Orchards, Groves, Vineyards, Nurseries, and Ornamental Horticultural Areas	Aor	Brown
	23. Confined Feeding Operations	Acf	
	24. Other	Ao	
3. Rangeland	31. Herbaceous Range	Rh	Light
	32. Shrub-Brushland Range	Rs	Orange
	33. Mixed	Rm	
4. Forest Land	41. Deciduous	Fd	Green
	42. Evergreen	Fe	
	43. Mixed	Fm	
5. Water	51. Streams and Canals	Ws	Dark
	52. Lakes	Wl	Blue
	53. Reservoirs	Wr	
	54. Bays and Estuaries	Wb	
	55. Other	Wo	
6. Wetland	61. Forested	Wlf	Light
	62. Nonforested	Wln	Blue
7. Barren Land	71. Salt Flats	Bsf	Gray
	72. Beaches and Mudflats	Bbm	
	73. Sandy Areas Other Than Beaches	Bs	
	74. Bare Exposed Rock	Br	
	75. Strip Mines, Quarries, and Gravel Pits	Bsm	
	76. Transitional Areas	Bt	
	77. Mixed	Bm	
8. Tundra	81. Shrub and Brush Tundra	Ts	Green-
	82. Herbaceous Tundra	Th	Gray
	83. Bare Ground Tundra	Tb	
	84. Wet Tundra	Tw	
	85. Mixed	Tm	
9. Permanent Snow and Ice	91. Permanent Snowfields	Ps	White
	92. Glaciers	Pg	

infrared wavelengths, a feature most useful for recognition of vegetation. Technical details of these instruments have been published in a number of papers, but the most authoritative is the Data Users Handbook (Goddard Space Flight Center, 1972).

The products from LANDSAT include computer compatible magnetic tapes in three formats, and images converted to photographic film in a variety of positives, negatives, transparencies, prints, black and white, and color composities. In film format the basic size is on 70mm film (55mm image width), with enlargements also available. Table II is a list of standard products with prices in U.S. dollars current in 1975.

TABLE II STANDARD LANDSAT PRODUCTS

IMAGE SIZE, cm	SCALE	FORMAT	UNIT PRICE U.S. $
BLACK AND WHITE			
5.5	1 : 3,369,000	Film Positive	2.00
5.5	1 : 3,369,000	Film Negative	2.00
18.6	1 : 1,000,000	Film Positive	3.00
18.6	1 : 1,000,000	Film Negative	3.00
18.6	1 : 1,000,000	Paper	2.00
37.2	1 : 500,000	Paper	5.00
74.4	1 : 250,000	Paper	12.00
COLOR COMPOSITE GENERATION			
18.6	1 : 1,000,000	Printing Master*	50.00
FALSE COLOR COMPOSITIES			
18.6	1 : 1,000,000	Film Positive	12.00
18.6	1 : 1,000,000	Paper	7.00
37.2	1 : 500,000	Paper	15.00
74.4	1 : 250,000	Paper	30.00
TRACKS		BPI (Bits Per Inch)	SET PRICE U.S. $
COMPUTER COMPATIBLE TAPES (CCT)			
7		800	200.00
9		800	200.00
9		1600	200.00

* NOTE: Printing Master is retained by EDC. Cost of products from this composite must be added to total costs. This $50 charge applies if a color master does not already exist for the desired scene.

The scale indicated in Table II results from the field of view of the satellite. The total swath width of ground coverage during each orbit is 185 kilometers in approximately the east-west direction. The north-south sizes of the frames of the RBV images are also approximately 185 kilometers, and the MSS images are formatted to correspond. Thus, each image contains data for over 30'000 square kilometers. One of the most useful products for land-use analysis is the 1:1'000'000 scale color composite transparency which costs £12.00. Data from it therefore costs less than $0.0004 per square kilometer.

Inquiries pertaining to availability of LANDSAT images and purchase orders should be directed to the U.S. Department of the Interior, EROS Data Center (EROS is an acronym for Earth Resources Observation System), Sioux Falls, South Dakota 57198, U.S.A.; telephone 605-594-6511. An inquiry should state the location of interest either as the location of a point or as an area rectangle, with coordinates in longitude and latitude. Time of year of coverage, specific inclusive date (if required), maximum percent of cloud cover, and minimum quality acceptable (ground, fair, poor, or very poor) should also be stated.

AUTOMATED CLASSIFICATION

Land-use information may be extracted from LANDSAT imagery by visual examination and transcribed to a map by means of a simple light table, projector, or "sketch master" projection. For areas larger than a few hundred square kilometers, however, this may be impractical from a labor and time viewpoint. With a photographic image of practical scale (perhaps 1:250'000 maximum), it is nearly impossible to achieve full use of the resolution limit of the original data -- about 80 meters on the ground. While the mind can discriminate and subsequently integrate data from two, and possibly three spectral bands sufficiently well to interpret the differences in the Level I categories of Table I, it cannot handle the complexity of using four bands of data, or possibly data from different seasons, in an attempt to discriminate Level II categories. There are techniques which can improve visual interpretation -- color additive viewing with operator control of hue and intensity, for example. When resources permit, many of these problems are solved by application of a digital computer and use of the LANDSAT magnetic tape recordings.

A number of different techniques have been developed for computer analysis of LANDSAT data, but at this time no particular one has emerged as the optimum in terms of accuracy, number of categories, or efficiency of time or cost. Experiments in the use of these techniques are on-going in universities, government agencies, and commercial establishments. Some of the latter offer an automated interpretation service, as well as commercial interpretation equipment, for a fee. (1) A group from the Netherlands studied several classification methods with emphasis on European cases, and published their recommendations (BEERS and VAN KUILENBURG, 1974). Their paper provided references to other publications on the subject. At each of the International Symposiums on Remote Sensing of the Environment (Ann Arbor, Michigan, USA) there have been about a dozen papers on automated interpretation. At the Ninth Symposium, for example, there were papers on a very advanced land-use classification technique (JONES, 1974) and a survey paper for non-mathematicians (PRESTON, 1974).

The experiments in automated interpretation have produced hundreds of land-use maps, primarily of areas within the United States. Many of these have not been checked for accuracy and must be regarded as experimental. Most of them use the classification system of Table I, or a variation of it. Three typical examples are the experimental maps of Greece (YASSOGLOU, SKORDALAKIS and KOUTALOS, 1973), part of Missouri (JOYCE and DERBONNE, 1975), and part of Alabama (JAYROE, LARSEN and CAMPBELL, 1974).

RETRIEVAL OF LAND-USE INFORMATION

The most common method for display of land-use information is in the form of maps produced by conventional cartographic methods. The arrival of large amounts of information and the need for frequent up-dating has caused a number of agencies to consider alternatives to the conventional map. Some examples of

automatic cartography have been published previously by the WLUS (BICKMORE and EVANS, 1970), and the foregoing discussion dealt with maps produced as computer outputs -- either by line printers or as tonal spots (possibly in color). Automation is clearly one way to produce land-use maps more efficently.

Going beyond maps, there is an increasing use of computer-managed information retrieval systems, especially among the larger resource management agencies. These were also discussed in a publication of the WLUS (TOMLINSON, 1970), and were the subject of two symposia on Geographical Information Systems in 1970 and 1972 under UNESCO and IGU sponsorship -- the proceedings of the second having been published by the IGU (TOMLINSON, 1972). Such a data system could be designed to produce maps as requested by the resource manager, with any degree of crudeness or sophistication as required and for which fund were available. The resource manager might agree to omit requirements for paper maps entirely (or in part), and rely on a video display for decision-making. In either case, the system could be designed to present land-use (and other) information in any scale, limited only by the resolution of the stored data. Systems of this type are already in use experimentally in several states of the USA. There is conceptual planning for a national system by the US Department of the Interior with the acronym RALI (Resource and Land Information).

It is timely to suggest that an international land-use information retrieval system should be planned, perhaps with sponsorship of an agency of the United Nations. This might develop independently, or it could grow from a national system or a regional system. An example of the latter is the teledocumentation network set up by the European Community for space documentation service. It uses remote dial-up terminals with video displays in several nations, tied to an IBM 370/155 computer at Darmstadt (ROMERIO, 1973).

EXAMPLES OF LAND-USE SURVEYS WITH LANDSAT DATA

Research in the use of LANDSAT data has been reported in two NASA-sponsored symposia (with a third scheduled at the time of this writing(2)). These have included papers on land-use survey: 28 papers in the first and 18 in the second. The proceedings of the completed symposia offer a wide selection of examples (FREDEN, MARCANTI, and BECKER, 1973 and 1974). Several of the papers were referenced in the preceding sections. One of particular international interest was that of the Food and Agricultural Organization of the United Nations (HOWARD, 1974).

The previously-mentioned International Symposiums on Remote Sensing of Environment at Ann Arbor, Michigan USA, also result in publication of many papers on land-use survey. The most recent was the Ninth, for which attention is directed to its Proceedings (Environmental Research Institute of Michigan, 1974)(3).

Particularly noteworthy is the work of the Instituto de Pesquisas Espaciais in Brazil. Using LANDSAT imagery they produced a map of natural vegetation of 70'000 square kilometers of Brazil with an expenditure of 69 man-days. The entire nation will be mapped at the 1 : 1'000'000 scale during 1975. A land-use map based on it will follow (NOSSEIR, 1975).

CONCLUSION

The LANDSAT series of satellites offer the opportunity for global surveys of land-use -- certainly at the millionth scale, probably larger. The costs of digital computers has dropped almost as dramatically as world-wide inflation has risen, so that it is practical to perform automatic analysis of satellite data and to retrieve it in an efficient manner. The reality of the situation was made clear by a statement of U. S. Secretary of State HENRY KISSINGER at the World Food Conference in Rome on November 5, 1974:"Next year, our space, agriculture, and weather agencies will test advanced satellite techniques for surveying and forecasting important food crops. We will begin in North America and then broaden the project to other parts of the world. To supplement the WMO study on climate, we have begun our own analysis of the relationship between climate patterns and crop yields over a statistically significant period. This is a promising and potentially vital contribution to rational planning of global production.

(State Department 1974)

NOTES

(1) It would be impractical to attempt a list of all interpretation services in this paper. Without wishing to imply an endorsement, several U. S. establishments can be mentioned to permit a reader to begin further inquiry: General Electric Company, 5030 Herzel Place, Beltsville, Maryland 20705, USA; Environmental Research Institute of Michigan, P. O. Box 618, Ann Arbor, Michigan 48107, USA; Laboratory for Applications of Remote Sensing, Purdue University, 1220 Potter Drive, West Lafayette, Indiana 47906, USA; Center for Research, Inc., University of Kansas, Lawrence, Kansas 66044, USA; Earth Satellite Corporation, 1747 Pennsylvania Avenue, N. W., Washington, DC 20375, USA; Bendix Aerospace Systems Division, 3621 South State Road, Ann Arbor, Michigan 48107, USA; IBM corporation, 18100 Frederick Pike, Gaithersburg, Maryland20760, USA; Daedalus Enterprises, Inc., P. O. Box 1869, Ann Arbor, Michigan 48106, USA; and Battelle Columbus Laboratories, 505 King Avenue, Columbus, Ohio 43201, USA.

(2) First NASA Earth Resources Survey Symposium, Shamrock Hilton Hotel, Houston, Texas, USA, June 8-13, 1975. Proceedings will be available from NASA's Johnson Space Center, Houston, Texas77058, USA.

(3) The Tenth International Symposium on Remote Sensing of Environment is scheduled for October 6-10, 1975. Proceedings will probably be available by mid-1976.

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EULUSMAP - AN EXAMPLE OF INTER-EUROPEAN SCIENTIFIC COOPERATION

E. Czati

The abbreviation Eulusmap stems from the words European Land Use Map (on the scale of 1:2, 5million). Its base map are 12 assembled sheets of the World Map on the scale of 1:2, 5 million, the great contribution of the 1970's for world geography and cartography accomplished by six socialist countries.

The Eulusmap has four sheets totalling 190x 126 cm. It covers Europe from the North Cap to Crete, including Iceland as well.

Its aim is to present the highly diverse land use of Europe in the early 1970's. This inter-European scientific cooperation was suggested, coordinated and edited by Hungary. The contributions range from processed statistical tables and complete national manuscripts to rough base maps and crude statistics. Scientists from the following countries participated in the work: Austria, Belgium, Bulgaria, Czechoslovakia, Denmark, France, Federal Republic of Germany, German Democratic Republic, Great Britain, Hungary, Ireland, Netherland, Norway, Poland, Portugal, Roumania, Spain, Switzerland and USA. Out of the nearly 20 countries listed five territories were compiled by Hungary, together of course,with the territories of the remaining countries which did not participate in the work for different reasons (such as Italy, Greece, Turkey, Albania, Finland, Iceland). Several attempts were made, however, to include specialists from these areas as well.

The Eulusmap is a great step towards the unification and standardization of the various types of land use maps produced in the last three decades by different European countries.

When the legend was drawn up a detailed study of the European land use presentation was made in order to avoid the inclusion of unrealistic demands. But emphasis was placed on the need to present as great a variety of information as possible, to introduce certain aspects of economic geography and also to introduce quantitative elements. An editorial concept was used during the colour scheme development to reflect as much as possible the cold coulours for northern territories, and relative warm colours for Central Europe and especially for the Mediterranian areas of the continent.

As arable land clearly plays a vital role, for easily understandable reasons, special attention was payed to its presentation. If arable land is more than 50% of the total area, it is shown as a cartogram subdivided into cereal, fodder crops, tuber-root crops, industrial crops and fallow subcategories. If its percentage is between 25-50%, the area is shown by the colour and screen of the cereal; and if its area is less than 25% of the total, then as mixed crop land.

As the size of the first grade administrative unit of each country - the cardinal of the quantitative presentation - differs greatly in Europe from 2000 km2 to 106'000 km2(Norrbotten in Sweden), to filter out the unevenness the second grade administrative unit of each country is taken into consideration for refinement.

Arable land is shown by various shades of orange.

Grasslands are in light green shade-variations from blue-green to yellow-green, containing subdivisions of cold grassland with five months permanent snow-cover. Wet grassland over 500 mm precipitations per year, dry grassland less than 500 mm precipitation annually, and alpine grasslands. If any kind of human intervention is performed such as re-seeding, melioration, irrigation etc., then the subtypes of grassland are presented as improved grasslands. All remaining grassland areas are shown as unimproved grasslands.

Permanent crops are generally shown on small scale land use maps by breakdown of fruits, wines, olives.

In order to show the complicated pattern of the permanent crops in Europe, orchards were subdivided into the following main groups:stone-fruits, soft-fruits, berries, nuts, citrus and mixed orchards. In these categories vines and olives are represented by special symbols. To reflect the inter-cultivation of southern Mediterranian Europe these two types are also combined with arable land, with fruits and with grasslands being shown as surface elements, as far as the scale permits.

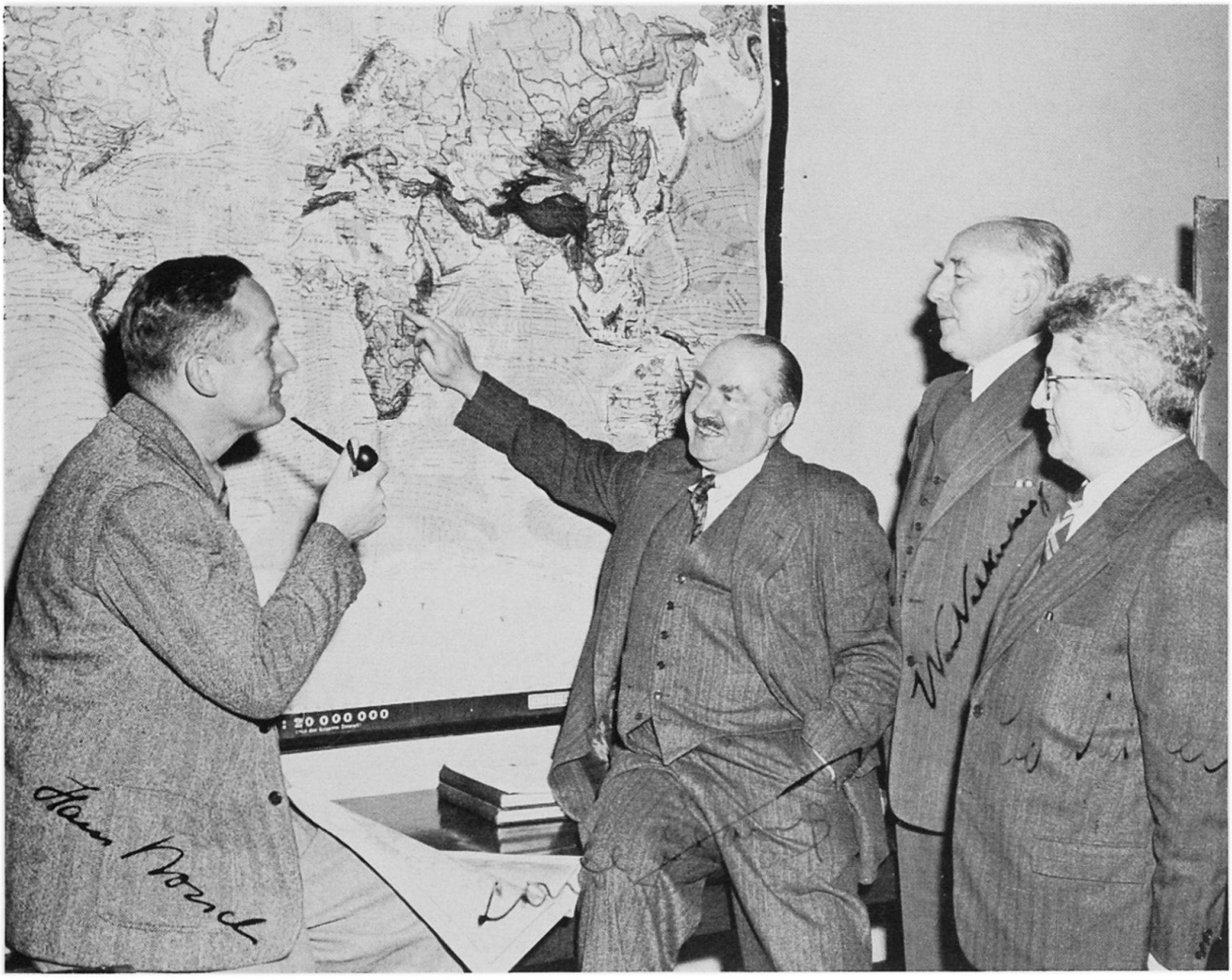
Land use maps generally present wood and forest areas in one category. In the Eulusmap woods and forests are subdivided into three main different groups - coniferous, deciduous and mixed (their combination). If forest is primarily for lumbering industry, it is shown as productive forest; but if lumbering is restricted to a certain level due to low productivity (1-2m3 per hectare) or for any other reason, such as

national parks, game reserves, then it is shown as unproductive. So forests are presented in various shades of green in six categories.

The wasteland is subdivided into barren rock (including also glacier areas) quicksands and other completely unproductive areas, not necessarily exposed rock (e. g. the fjell regions of Scandinavia).

Of course, the built-over lands are also shown.

Dominant crops on arable land areas are represented by 20 different symbols, and 15 symbols indicate the dominant tree types. In the course of editing, the areal distribution of forests was checked, for certain sections of Europe, on the basis of Landsat-1 pictures, partly monochrome of band 4, and partly false-colour. In this way, a satisfactory generalization could be achieved, especially for Yugoslavia, Greece and Turkey. ERTS pictures were used for the same purpose in parts of Hungary, France, Norway, Denmark, and Sweden.



Meeting at Clark University, Worcester, Mass. USA, April 1949.
From right to left: L. Waibel, S. van Valkenburg, L. D. Stamp, H. Boesch.

THE WORLD LAND USE SURVEY

A. Clark

GEOGRAPHICAL PUBLICATIONS LTD

It was early in the 1930s that the late Sir DUDLEY STAMP appreciated the need for a factual record of the existing use of land in Britain, and inaugurated the Land Utilisation Survey of Britain. In the *Land of Britain: Its Use and Misuse* (LONGMAN) he summarised the findings of the Survey and also revealed, as he recounted the Survey's history, how hazardous had been the financing of it; how the Survey became the subsidiary of a 'small private publishing company'; and how 'fortunately the profits from my own books ... have been able to meet the net annual losses of the Survey'. The small private company was Geographical Publications Ltd which published tho one-inch maps and county reports of the Survey; and the statement about 'profits from my own books' glosses over the many years spent on the treadmill of writing, and revising for the umpteenth edition, and writin yet another book, in order to provide for the voracious, insatiable appetite of the Land Utilisation Survey. All the royalties earned by Sir DUDLEY went into Geographical Publications to be used for publication and research; he himself never received a penny in royalties.

THE WORLD LAND USE SURVEY

By the time the Commission on a World Land Use Survey came into being the work of publishing the Land Utilisation Survey was complete and, inspired by Dr. S. VAN VALKENBURG, Sir DUDLEY turned his attention to world land use. He set up a Research Office in London, financed by Geographical Publications Ltd., and housed, by the benevolence of each institution, at first in King's College London, later at the Royal Geographical Society. Research was undertaken to test the validity of the classification of categories of land use discussed at the Commission meeting in Worcester, Mass. in 1949. Experimental land use maps of widely differing areas were drawn up, including several compiled solely from aerial photographs; information and advice on the use of the land use classification were distributed to enquirers who wrote from all parts of the world.
Sir DUDLEY envisaged a series of memoirs to accompany the national sheets of the 1:1 million map, but this idea faded with the abandonment of the map. The Research Office was closed and The Monographs and Occasional Papers of the World Land Use Survey came into being, as pilot studies. The Monographs followed along the lines of the County Reports of the Land Utilisation Survey of Britain - detailed works covering particular areas, dealing with land use, but including related topics, studied in depth. Of these D. CHRISTODOULOU: *Cyprus* and J. H. G. LEBON: *Sudan* have become accepted as definitive works. The scope of the Occasional Papers was planned to be more diverse, so that studies allied to but not necessarily focussed on land use might be included. This flexibility led to the inclusion in the Occasional Papers of reports on projects concerned with technical assistance given in rural communities by the expert agricultural teams of Shell International Petroleum Ltd.
The Monographs and Occasional Papers are all factual studies, with two notable exceptions, which deal with the techniques of land use survey mentioned by Professor BOESCH earlier: the report of the Shell Symposium published as *New Possibilities and Techniques for Land Use and Related Surveys*: and *Contributions to Land Use Survey Methods*.
The financial resources of Geographical Publications Ltd permitted only a small printing of each of the Memographs and Occasional Papers. From the full list of published works which follows it will be noticed that some are unfortunately already out of print; copies of the others are obtainable from the Company's distribution centre: Geographical Publications Ltd., Wellcombe, Goveton, Kingsbridge, Devon, U.K.

MONOGRAPHS

1 LAND USE IN HONG KONG AND THE NEW TERRITORIES Thomas R. Tregear. With coloured Land Use Map 1:80,000. 1958 (out of print)

2 THE EVOLUTION OF THE RURAL LAND USE PATTERN IN CYPRUS By Demetrios Christodoulou With coloured Land Use Map, 1:253,400 1959 £1.65 (map seperately folded, 17½p)

3 LAND USE AND POPULATION IN TOBAGO By David L. Niddrie. With Map 1960 70p

4 LAND USE IN SUDAN By J. H. G. Lebon With Map 1965 (out of print)

5 FOUR ISLAND STUDIES Santa Maria (Azores) Faial (Azores), Eastern Madeira and Zanzibar By H. Prince, J. M. Callender and J. D. Henshall; C. D. Smith; M. E. Caistor With Map 1968. £2.00

OCCASIONAL PAPERS

1 LAND USE STUDIES IN THE TRANSVAAL LOWVELD By Monica M. Cole. 1956. 40p

2 A SUBSISTENCE CROP GEOGRAPHY OF UGANDA By David M. McMaster. 1962. (out of print)

3 LAND USE STATISTICS OF THE COUNTRIES OF EUROPE By L. Dudley Stamp. 1965. 70p

4 BORGO a MOZZANO By L. E. Virone With coloured Land Use Map, 1:25,000 1963 £1.00

5 THE NORTH SEA By L. E. J. Brouwer THE LAW OF THE CONTINENTAL SHELF WITH SPECIAL REFERENCE TO THE NORTH SEA By The Rt. Hon. Lord Shawcross, P. C., Q. C., 1964 70p

6 UBOMA By H. A. Oluwasanmi, I. S. Dema and others With Maps. 1966. £1.65

7 THE TRANSFORMATION OF RURAL COMMUNITIES By L. E. Virone, C. Pellizzi and others. 1966 (out of print)

8 SARAPHI By Kamol Janlekha With Map. 1968 £1.85

9 NEW POSSIBILITIES AND TECHNIQUES FOR LAND USE AND RELATED SURVEYS By D. P. Bickmore, H. Boesch, J. Kostrowicki and others.
With Map by automatic cartography. 1970 £2.00

10 CONTRIBUTIONS TO LAND USE SURVEY METHODS By H. Boesch, K. Brassel, P. Koch, R. Schmid. 1971 £2.50

11 WELENKOMI: A SOCIO-ECONOMIC AND NUTRITIONAL SURVEY OF A RURAL COMMUNITY IN THE CENTRAL HIGHLANDS OF ETHIOPIA By Mesfin Wolde-Mariam and others. 1971. £2.50