PEDOMETRON

PEDOMETRON **Sydney, May 1996, Number 4 & 5**

Newsletter of the International Society of Soil Science Working Group on Pedometrics (PM)

Pedometrics Chair: Professor Alex B. McBratney Secretary: Dr Jaap J. de Gruijter Editor: Dr Inakwu O.A. Odeh

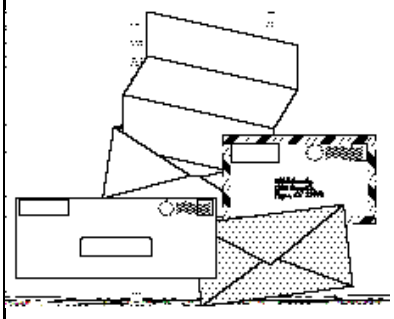
From the Chair

Since the last Newsletter was published the Pedometrics Working Group had a very successful meeting in association with the Soil Science Society of America at their Annual Meeting in St Louis. The full-day Symposium encompassed the range of applications in fuzzy sets in soil science, from measurement to classification, soil mapping and land evaluation. Other possible applications including some in soil physics were discussed. The dozen or so half-hour talks were very busy with a range from 50 to 150 attendees throughout the day. Plenty of time was left for discussion and this lead to a very incisive and productive question-and-answer session. Feedback from the Soil Science Society of America was very positive. I'd like to thank the SSSA for allowing us to participate in their program, and in particular I gratefully acknowledge the efforts of the participants and my co-chair Dr Kevin McSweeney of the University of Wisconsin. The papers from the Symposium are now being refereed for a Special Issue of Geoderma which I hope will appear early in 1997. Publication of this issue should see a widening of the application of this powerful set of techniques in soil and environmental science. Further details on the progress of this Special Issue and other aspects of fuzzy sets in soil science are available from a list server at the University of Wisconsin (more details below). This year the pedometrics Working Group will be involved in two Symposia, one in Melbourne and one in Wageningen. The details of these are given on pp. 5 and 6 respectively. Finally, I couldn't possibly finish without some reference to the poetic canon. Here's a poem I unearthed which, I guess, says something about fuzzy sets or is its meaning too fuzzy to be discernible?

FUZZY DIAMOND

He is a hard-set man
Everything in sharp
Contrast
Black & white
Nothing grey
Cut as clear as
Night & day
Decisions made
Yet he knows
He is aware
He extols
The virtues of
The fuzzy world
The power of
Continuity
Of warm grey
The logic of
Compromise
It seems
He has no control
His heart is
Fuzzy as a diamond
His mind is
Steely as pure merino

- David van der Linden



From the Newsletter Editor

We could not publish the Volume 4 of the Pedometron in September 1995 as scheduled in the last issue. This is because of numerous engagements by the Editor, the Chair and the Secretary of the Working Group on Pedometrics, especially their involvement in the Symposium on Fuzzy Sets in Soil Science, held during the SSSA Annual Meeting at Missouri, October 30, 1995. We are therefore combining Issues nos. 4 and 5.

We continue to need inputs from readers. The next issue of Pedometron is due to be out by November 30, 1996. We are inviting you to contribute items for inclusion in the Newsletter. Areas in which we would like contributions to cover include:

1. A short review of a topic of your choice, e.g., recent advances in pedometrics, developments in soil science and the role of pedometrics, etc.

2. An abstracted version of your recent publication(s) in soil science journals.

3. Titles and abstracts of recent theses in which you were involved.

4. An ode to the gods of earth or something similar.

5. Or any other topic of your

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choice relevant to pedometrics in particular and soil science in general.

Fuzzy mailing list

As mentioned by the Chair above, there is a new mailing list for the Fuzzy Analysis of Landforms and Soils. The list has been established to facilitate discussion on the use of fuzzy logic in Soil Science. The idea to initiate a mailing list was muted at the Symposium on Fuzzy Sets in Soil Science. Related issues can also be raised and discussed.

To subscribe, send a message to

"listserver@relay.doit.wisc.edu"

by typing:

suscribe fals Your Name

To unsuscribe send a similar message with the first line as

unsuscribe fals

You have the option of concealing your email address and your name to allow only the suscribers on the list to have access to them. To change your conceal option, send an email to

listserver@relay.doit.wisc.edu.

Leave the subject line blank. The content of your email should be (without < >)

set <listserver> conceal no.

On Pedodiversity

I present below the responses by **Dr J. J. Ibánez** and **Prof D.R. Nielsen** (UCDav) to **Alex McBratney's** pedodiversity article published in the last issue of Pedometron. Several issues raised need to be discussed in this group, if we are to avail ourselves of the opportunity provided by this forum.

The first is whether the concept of pedodiversity is widely accepted (no doubt it is), and if so, how do we proceed further? Is the concept of biodiversity directly applicable to the soil system? Is the pedodiversity concept useful in the advancement of soil science in general, and pedometrics in particular, specifically in the realm of environmental studies that are becoming increasinly important? We may, in our effort to expand on this concept, opt for a multidisciplinary approach, bringing in biologists, ecologists, geomorphologists, etc. for development of a comprehensive framework for pedodiversity.

The second concerns pedodiversity measures: if pedodiversity is measurable, of which Alex and Dr Ibánez all agreed albeit differently, how do we go about it and at what scale for which purpose? Both Prof McBratney and Dr Ibánez concurred on the usefulness of pedodiversity in fostering the need for and delineation of soil reserves (as biodiversity is useful for decisions regarding forest and other ecosystem reserves). A suggestion by Prof McBratney that we utilise the geostatistical tool of variogram as measure of pedodiversity may be worth pursuing further.

In response, Prof Nielsen proposed that we also include measures that reflect the "scale of time", dealing with not only the past (palaeo) but also the present features of the soil, in order to cater for future sustainability of the soil system. He conceived of the idea that we should, at a regional scale, use fuzzy sets to link the lithosphere, biosphere and atmosphere to better understand the feedback loops at the local scale.

The soil system is multivariate. How do we resolve the overlapping nature of soil types and soil properties in both geographical and taxonomic context when applying variograms to gauge pedodiversity or even the taxonomic pedodiversity? It is obvious that soil properties vary differently at the same scale. Also not all soil properties, as currently determined, are of numeric continuous scale, but may be of nominal or ordinal type; the latter two are not always spatially dependent enough for variogram modelling. Perhaps, we need to do more on the scaling of soil properties that are relevant to various land uses and soil sustainabilty than is presently done.This requires a measure of *soil quality.* There are various measures of the soil quality depending on present or potential land uses, and when all potential uses are included, then "functional" pedodiversity, in which the land versatility is determined, can be considered. Functional pedodiversity is, perhaps, one of the best options to pursue further.

(Editor)

PEDODIVERSITY: PEDOMETRICS AND ECOLOGICAL RESEARCH

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The Background of Pedodiversity and Pedogeomorphic Diversity

The idea of pedodiversity is probably as old as the science of pedology. Soil surveyors analyse and represent the soilscapes of defined territories, so they can recognize that certain landscapes are "richer" and more diverse than others. The first explicit mention of the pedodiversity concept however seems to be much more recent. As pointed out by McBratney (1995) in the April 1995 issue of the Pedometron, it was the Russian School of soil geography (Fridland, 1976) who first explained the importance of this concept in their studies of soilscape patterns. Then, in their monographic work "Soil Landscape Analysis", Hole and Campbell (1985) tackled the concept of pedodiversity and its measurement in more detail and more strictly. These authors, based the concepts of heterogeneity of patterns of soil cover as synonymous with diversity of soilscapes (pp. 38). They proposed the Index of Taxonomic Contrast (pp. 61) and the Index of Heterogeneity (pp. 63).They also made a bold attempt to tackle the problem of soil-body size distribution (pp. 63), a widely

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studied topic in the area of biodiversity under the name of taxa abundance models. Unfortunately, neither the proposals of Fridland and his co-workers nor those of Hole and Campbell achieved the wide acceptance that, in my opinion, their works deserve.

Nevertheless, Arnett and Conacher (1973), as far as I know, were the first authors to show, albeit indirectly, how the hierarchisation of drainage basins induces an increase in richness (number of different objects to occur in a defined landscape unit) of landsurface units using the Nine-Unit Landsurface Model (Conacher and Dalrymple, 1977). The Nine-Unit Landsurface Model, although follows the tradition of pedogeomorphic research, did not arouse the interest of pedologists.

In 1986, I defended my dissertation "Landscape Ecology and Edaphic Systems in the Massif of Ayllón, Central Range, Spain". As a career biologist, I was quite familiar with studies on biodiversity. Unaware of the works of Fridland (1976) and Hole and Campbell (1985), I tackled the diversity of soilscapes starting from the work of Arnett and Conacher (1973) and the methodologies that existed in biodiversity studies. Our first paper on pedodiversity to appear in an International Journal was in CATENA (Ibanez et al, 1990), and four years later we published a second paper on geomorphological diversity in Z. GEOMORPH N.F (Ibánez, 1994). Both papers examined the concepts of Richness and Diversity or negentropy (in this case diversity is defined as a function of the number of different pedotaxa and geomorphological units and their relative abundance or cover) and their applications in analysing soilscape-drainage basin and landform-drainage basin relations.

Meanwhile, McBratney (1992) had also addressed the application of the pedodiversity concept in pedologic research. McBratney, in his Pedometron article, mentioned the difference between taxonomic pedodiversity, functional pedodiversity and diversity of soil properties in which he noted, inta a'lia:

"The preceding discussion measured diversity relative to soil classes and might be termed ***taxonomic pedodiversity****. This approach can be improved by knowing the relative taxonomic distances between classes. Another way of looking at and measuring pedodiversity is to consider what the soil does. In a sense this is what land evaluation, particularly the notion of land capability, or as I prefer to call it – land versatility, does – at a single point.* ***Functional pedodiversity*** *may be measured by the within-block variance of land versatility (to a wide range of alternative uses or to the support of a diverse biological community)."*

Some colleagues and referees have objected that the criteria used in current soil classifications do not enable taxonomic pedodiversity studies to be satisfactorily tackled. As a representative example, I shall quote one of the referee's arguments:

"....the classes are designed for agriculture, and where agriculture is marginal, the soil may appear through the classification to be less diverse.... dry and cold climatic regimes are less well explored, populated and used for agriculture. Soil class differentiae are biased towards temperate and Mediterranean climates..."

I fully agree with this objection. However, this should not prevent the best estimates from being made with available material. This type of review demonstrates the lack of knowledge with regard to many of the problems occurring in research work on biological taxonomy and biodiversity. Similar comments abound in bibliography on biodiversity (and not only as far as microbian taxonomy is concerned). I would recommend those pedologists with this kind of doubt to read, for example, comments by Harper and Hawksworth (1995) and May (1995).

This is not a new distinction in the field of biodiversity since species diversity is not the only kind of ecological diversity (e.g. Harper and Hawksworth, 1995); ecologists have studied niche width diversity, structural and habitat diversity, diversity of trophic levels, diversity of functional groups, etc. Like species diversity, those other forms of ecological diversity can be measured using either simple richness indices or more complex indices.

Pedodiversity and pedometrics research.

McBratney (1995) further commented on the importance pedometrics research may have (particularly geostatistics) in future research on pedodiversity. In my opinion, there is little doubt that this line of research has a lot to offer. However, if we want pedology to become more important in the sphere of environmental sciences and, specifically, within ecological research, we should reflect on certain aspects of strategic interest.

First, ecology has developed a body of teaching on the biodiversity topic which is worth bearing in mind as a reference point. Ibánez et al. (1995a, 1995b) have shown how indices and models used for estimating biodiversity may also be employed to determine pedodiversity. This type of approach will enable pedologists and ecologists to use a common language, facilitating the flow of knowledge between both disciplines. Being able to determine the diversity of different ecosphere subsystems (e.g. plant communities, soilscapes) by the same body of methodologies will enable their respective regularities to be analyzed and compared. Thus, ecologists will effortlessly understand the substantial contributions that pedology can make to improve our understanding of how ecosystems and the ecosphere function. For instance, in the conclusions of a previous paper (Ibánez et al., 1995b), we wrote:

"As has been seen, pedodiversity indices in soil landscape analysis seem to follow similar patterns in some aspects as those established for biodiversity in suggests that there are universal regularities common to the organization of biotic and abiotic ecological structures. The need to draw up testable hypotheses enabling the underlying causality to be explained, quantified and modelled is obvious."

Unfortunately, methodologies for studying biodiversity have not incorporated geostatistic tools. This does not mean that this type of research is intractable. On the contrary, I am of the opinion that pedometricians have a lot to contribute to ecological research. These contributions would be both thematic (incorporating a strict study of the soil system into ecological research work) and methodological (drawing up indices and models combining the traditional ecological perspective of diversity and that of spatial variability). In other words, what I am trying to say is that pedodiversity studies should incorporate both types of approaches. Otherwise, a great risk of both perspectives remaining disconnected exists. I think that this latter possibility would, frankly speaking, negate the strengthening of the role of pedology in the context of environmental sciences.

Pedodiversity and National and International Soil Reserves

McBratney (1995) also comments that this type of approach offers the chance of drawing up "optimal national or international soil reserves". And I agree entirely with him. Nevertheless, as we pointed out elsewere (Ibánez et al. 1995b): "The characterization and quantification of pedodiversity (as well as geomorphological and lithological diversity) as a non-renewable natural resource should be taken into account when estimating a territory's ecological values". In other words, it would be much better to integrate our scientific discipline with other ones for selecting national or international ecological reserves than to separately address the creation of soil reserves (specialists of other earth science subjects, geomorphologists, hydrologists, etc. could legitimately aspire to doing the same). In any event, neither initiative excludes the other.

Renowned ecologists (e.g. the Australian Chief Scientist, R.M. May and the British Research Adviser, E.O. Wilson) recognized that one of the big challenges faced by the study of biodiversity is the analysis and classification of edaphic microflora and microfauna. There is not the slightest doubt that setting up soil reserves covering the largest number of types of soil possible (including their undisturbed surface horizons where most biological activity is concentrated) is a guarantee for preserving unstudied biodiversity. This aspect gives value added to the creation of soil reserves, inasmuch as aspects of the soil ecosystem's biodiversity would have to be added to those of the aforesaid pedodiversity preservation.

Finally, it is worth noting that the choice of territories for setting up soil reserves should not be based on one or few pedological criteria. Obviously, estimation of pedodiversity can and should be one of the most relevant. However, it would also be necessary to consider other aspects such as the presence of palaeosols, representative of past periods under different ecological conditions, the existence of pedotaxa and pedogenetic processes infrequent in the soil regions considered (pedological singularities), etc. Likewise, the concept of pedodiversity (taken here as a variety of pedotaxa, soil horizons and soil properties) should be supplemented with the diversity of soilscapes. It is currently possible for various soilscapes in their natural state (i.e., including their original structures, functions and dynamics) to be running a real risk of destruction or irreversible disturbance. In some sense, this process would be similar to the extinction of biological species (particularly when soilscapes were generated under environmental conditions different from the present).

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Pedodiversity- a great idea- Prof D R Nielsen

The April issue of Pedometron is great!! Your article on pedoversity was thought-provoking, and I enjoyed it!! I liked and fully appreciated the way you introduced pedodiversity and followed up with a discussion of its measurement. On the other hand, it was a surprise for me that you next introduced "optimal soil preservation strategies" because you opened the same old door of preserving and saving everything and even brought up topics of "extinction" and a "design of reserves to eptitomize what is (to be) saved". In that sense, you behaved as a typical, present-day nostalgic pedologist! Sorry!

And in your last section, reconstruction pedology, you refer to those areas that have been "degraded" and speak of "natural pedodiversity". Fortunately, you explicitly recognized your academic error of neglecting time-dependent processes by using the words "quasi-natural soil systems"! I suggest that you include the scale of time in your intellectual framework of pedodiversity instead of looking and measuring the here and the now of the landscape. Why look for the most present-day pedodiverse soil, the next most etc. and develop a hierarchical or numerical scheme of today's soils? Why not look to the past and the future simultaneously and make pedology a living science instead of a museum artifact? As a result of the thoughtfulness of Jenny and many others who included time as one of the independent variables of soil genesis, we should not exclusively focus our thoughts on how we got to the present, but we should extend our consideration to that achieveable in the future - and as you suggest Alex, examine pedodiversity in relation to "maintainig unique soil materials crucial to our well being". I can only add that we should do so for not only our well being but for that of other organisms of the past and those potentially able to develop in the future. It also seems to me that at the regional scale, we should start using fuzzy sets in soil science to better link land-atmosphere energy and momentum exchanges. If we did, and better understood the feedback loops between the landscape and the local atmosphere, we would have a better knowledge of the time-rates of change of soil attributes and soil genesis. Those feedback loops are best studied by soil scientists, not atmospheric scientists, if we could get out of the rut of classifying soils without a dimension of time and only looking at soils as a higher plant substrate.

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I shall reply to Professor Donald Nielsen's incisive comments in the next issue. I would welcome comments on this.

-Alex McBratney.

Calendar

Fifth International Geostatistics Congress

September 22 - 27, 1996, The fifth International Geostatistics Congress will be held in the Novotel Hotel, Wollongong, NSW, Australia. The unique event provides a forum for dissemination of innovative ideas in geostatistics. For further enquiry, contact: Ernest Baafi, GEOSTAT 996, Department of Civil and Mining Engineering, University of Wollongong, Wollongong, NSW 2522, Australia.

Fax: 61 42 21 3238
Phone: 61 42 21 3031 or
61 42 21 3040

Notable oral papers in the area of Pedometrics include:

Accounting for local uncertainty in environmental decision-making **processes, Goovaerts, P.** , Universitè Catholique de Louvain, Belgium .

Comparison of three kiging methods for making soil remediation decisions, **Buxton B. & Luise G.**, Battele Memorial Institute USA.

Spatio-temporal kriging of soil water content, **Heuvelink G. B. M.**,

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University of Amsterdam, The Netherlands.

Geostastics & cost-effective environmental restoration, **Rautman C. A.**, Sandia National Laboratories, USA.

Methods of predicting soil properties from ancillary information: Non-spatial models compared with a geostatistical method, **Odeh I. O. A. & McBratey A. B.**, The University of Sydney & **Slater B.** QLD Department of Primary Industries, Australia.

Geostatistical modeling of environmental variables at mine sites, **Pereia H. G., Ribeiro L., Soares A., Pathina P. & Pereia M. J.** CVRM, Portugal.

Using guess fields & recursive estimation to map soil pollution in urban ares, **Bierkins M.**, University of Utretch, The Netherlands.

Geostatistcal analysis of soil flux in South-West Niger, **Chappel A.**, University College London & **Oliver M. A.**, University of Reading, UK.

Selecting panels for remediation in contaminated soils via stochastic imaging. **Kyriakidis**, Stanford University, USA.

Geostiatistical simulation for upscaling field measurements of unsaturated hydraulic conductivity, **Miller S. M.,** University of Idaho USA.

Analysing a pollen profile using the multivariate variogram , **Oliver M. A.** University of Reading & **Webster R.**, Rothamsted Experimental Station, UK.

And for something completely different:

Gregorian song & music of the hebraic bible: variography on music notes, **Maignan M.**, University of Lausanne, Switzerland.

...and a lot more.

The Spruce-IV Conference

September 8 - 12, 1997, The Spruce-IV conference will take place at the ITC, Enschede, The Netherlands. The theme of the conference is *Health and the Environment*. For more information please contact Prof. A. Stein, ITC, P.O. Box 6, 7500 AA Enschede, The Netherlands. Email: spruce @itc.nl.

Meetings by WG-PM

1996

Symposium on "Soil Resource Assessment".
July 4, 1996. Jointly organised by Pedometrics Working Group of ISSS, Australian Collaborative Land Evaluation Program (ACLEP), and the Australian & New Zealand Societies of Soil Science

Part of the Program of the Australian Society of Soil Science & New Zealand Society of Soil Science Conference, July 1-4 1996.

July 4 1996
University of Melbourne

Keynote address

Professor J. Bouma, Department of Soil Science & Geology, Agricultural University, Wageningen, The Netherlands.
Role of quantitative approaches in soil science when interacting with stakeholders.

Papers

B. Slater & M. Grundy. Enanced land resource assessment in the

N.J. McKenzie, P. Ryan, P. Loughhead & L. Ashton. Quantitative survey design for forest soil surveys.

P.E. Gessler, N.J. McKenzie & M.F. Hutchinson. Statistical soil-landscape modelling for prediction of soil patterns.

R.N. Thwaites. Forest land resource assessment: the role of digital modelling to predict regolith-terrain parameters.

J. Trantafilis & A.B. McBratney. Use of EM induction and geostatistical methods to describe the spatial distribution of soil salinity

D.C. McKenzie, A.B. McBratney & B.J. Button. Aircraft-mounted video sensors can characterise the patterns of variation of soil structure under irrgiated cotton.

S. Officer et al. Putting variability to work: The use of multivariate statistics to describe potassium distribution in hill-country soils.

I.O.A. Odeh. A fuzzy multi-criterial approach to field soil description: an example.

A.J. Todd, I.O. A. Odeh & A.B. McBratney. Land-use/soil relationships in the lower Macintyre valley, NSW.

A.B. McBratney, B.M. Whelan & R.A. Viscarra Rossel. Implications of Precision Agriculture for soil resource assessment.

P.R. Podila. Land suitability evaluation for soybean using an expert system ALES.

P.N. Bierwith & R.M. Johnson. Mapping soil properties with airborne gamma-spectrometry images.

Contact: The symposium coordinators:
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Workshop on Soil and Water Quality at Different Scales
August 7 - 9, 1996, Organized by the three ISSS Working Groups, **Moisture Variability, Pedometrics** and **Soil Pollution** of the ISSS.

To obtain a state-of-the-art picture of interdisciplinary research in the context of soil quality, the three working groups of the ISSS are organising a workshop focusing on integrated case studies on soil and water quality, with special emphasis on scale aspects. For further information contact: Dr P.A. Finke
DLO-Winand Staring Centre for Integrated Land, Soil and Water Research, P.O. Box 125.
6700 AG Wageningen,
The Netherlands.

Fax: +31 8370 24812
Phone: +31 8370 74258
Email: p.a.finke@sc.agro.nl

Wednesday, 7 August 1996

Session I Scale issues in case studies.

J Bouma *General Introduction*

J Dumanski *Relevance of scale dependent approach for development of Land Quality indicators*

R J Wagenet *Scale issues in agro-ecological research chains*

D E Radcliffe *Solute transport at the Pedon and Polypedon scales*

T S Steenhuis *Mapping and interpreting soil texture to assess nitrate movement at lysimeter to field scales*

C Alewell *Investigating the impact of anthropogenic depositions on plants, soil and groundwater at different scales in a catchment: the Waldstein case study*

W Wenzel *Modelling the effect of acidification on metal mobilisation at different scales*

R E Knighton *Scale differences of nitrogen loading under corn production to ground and surface water*

P Curmi *Hydromorphic soils and control of nitrate fluxes: spatial distribution and functional modelling at different scales*

D King *Scale transfer of a simple soil erosion model from small area to a large region*

Thursday, 8 August

Session 1 Scale issues in case studies.

C. Beierkuhnlein *The contribution of sulphate reduction to buffering of acidity in the Frankenwald, Bavaria*

F Wendland *The influence of nitrate reduction strategies on the temporal development of nitrate pollution of soil and groundwater throughout Germany- A regionally differentiated case study*

J J Stoorvogel *Research on soil fertility decline in tropical environment: integration pf spatial scales*

R Groot *Food supply capacity study at global scale*

Session II Methodological aspects

A McBratney *Methodological aspects associated with up- and downscaling*

W. de Vries *The use of upscaling procedures in the application of soil acidification models at different scales*

A Papritz *Nitrogen leaching from prealpine spruce ecosystems at several subcatchment scales*

M R Hoosbeek *Soil variability and model uncertainty at three different scales*

Friday, 9 August

Session II Methodological aspects

I O A Odeh *Modelling the soil environment of irrigated cotton region of eastern Australia*

J L Meshalkina *Soil adsorbing complex properties of Russian boreal soils and its dependence on the spatial scale of the study area*

Session III Review papers

To be advised *Modelling concepts and their relation to the scale of the problem*

M J W Jansen *Uncertainty of model results as a result of the uncertainty of basic data and modelling concepts*

G Heuvelink *Uncertainty of model results as a result of a sequence of up- or downscaling actions in the research procedure.*

1997

Pedometrics Conference
5 day conference in USA, August/ 27 - 31, 1997

Venue: University of Wisconsin, Madison

Chief Organiser: **Dr Kevin McSweeney** (Dept of Soil Science)

Subject: General (see page 9)

1998

Proposed
1 day symposium in association with the ISSS meeting in August, in Montpellier, France.

Subject in keeping with the theme of the conference,(provisional): **Quantifying the human impact on soil variability and pedodiversity.**

Recent appointments at ITC.

Three new Professors were recently appointed at the International Institute for Aerospace Survey and Earth Research, Enschede, The Netherlands.

The three are **Dr W. Kainze** (Spatial Information Theory and Applied Computer Science), **Dr Ir. A Stein** (Spatial Statistics) and **Dr Ir. P.M. Driessen** (Modelling in Quantified Land Evaluation). They

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gave their inaugural lectures on Friday 6th of October 1995.

Professor Krainze, a graduate of the University of Technology, Graz, Austria, addressed the goals of *Spatial Information Theory and Applied Computer Science* in his inaugral address. He reiterated the achievements of different fields dealing with spatial reasoning, representation and human understanding of space. "Making better (GIS) tools requires a good understanding of the underlying principles of spatial information as well as the techniques and procedures of transforming spatial phenomena into useful representative structures and functions for modern GIS", he pointed out. Professor Kainze emphasized that the field of Spatial Information Theory and Computer Science will continue to contribute to the making of better tools for the emerging new applications through studies of spatial data models and structures, relationships between spatial objects based on mathematical principles, real three-dimensional representation of spatial phenomena, etc.

Recently there have been new developments in information science. Dr Ir. A. Stein, appointed as a visiting Professor of Spatial Statistics, looked at the challenges facing spatial statistics in contributing to these advances. A graduate of the University of Technology, Eindhoven and Landbouwhogeschool Wageningen (Agricultural University), Professor Stein explained that spatial statisitics are aimed at "analysing spatially collected data, that is, data for which the locations of measurements are essential." With increasing availability of data [describing the natural phenomena], there is the need to extract useful information, and the role of spatial statistics is invaluable, he said. He emphasized the need to use existing information and opined that recent developments indicate that data-driven statistics may well replace the model-driven statistics.

Dr Ir. Driessen, also a visiting Professor, addressed the issue of the development of a land evaluation framework, of which the title was coined as *Exercise in common sense*. Dr Driessen obtained his doctorate from the Agricultural University Wageningen in 1970 and was involved with a variety of projects, many of them in Indonesia. Land evaluation was poorly structured back in 1970, and therefore needed a framework, he said. Proliferation of quantitative methods of land evaluation followed the developement of the "framework" meaning "new applications of data on land and land use". Professor Dreissen said that there are 'established' concepts that are wrong and misleading. It is therefore time that the land evaluators made the data more explicit and that procedures are developed for regorous screening of the only hard information there is: primary data on land and land use, he said. "Exercises are needed; exercises in common sense", Professor Driessen pointed out. He foresaw the increase in demand for land evaluators and land use planners as the increase pressure on land by beugeoning world population would lead to additional 4.5 million km^2 of land for agricultural production.

Best Paper Award 1994

Best Paper Award

In continuation of nomination and selection of the yearly best paper in Pedometrics, published in the leading international Journals, the Secretary of the Working Group, **Dr J.J. deGruijter** made the pre-selection of papers for readers of Pedometron to select the best paper for the 1994 award. The abstracts of the pre-selected papers are presented below. **Readers should please read through the abstracts (or preferably the full papers) and vote on the ballot paper provided.**

The nominated papers are:

Bell, J.C., Cunningham, R.J. and Havens, M.W. 1994. Soil drainage class probability mapping using a soil-landscape model. Soil Sci. Soc. A. J., 58(2): 464-470.

Abstract

The direct application of quantitative models for soil mapping has been limited by technological constraints. This study combines a

Please indicate your order of preference for the Pedometri
for 1994 by allocating a number between 1 for the best pre
for least preference tiltle:

Bell, J.C., Cunningham, R.J. and Havens, M.W. _____

Bierkens, M.F.P. and Weerts, H.J.T. _____

Butcher, B., Hinz, C. and Fuhler, H._____

Crawford, J.W. _____

Goovaerts, P. _____

Please send your vote by July 31, 1996, to the Secr
Jaap de Gruijter,
DLO Winand Staring Centre for Integrated Land, Soi
Research, PO Box 125, 6700 AC Wageningen,
The Netherlands

statisitically based soil-landscape model and geographic information system (GIS) technology to create soil drainage class maps. An existing soil-landscape model that predicts soil drainage class from parent material, terrain, and surface drianage feature proximity variables was used. A digital geographic database of parent material, terrain, and drainage feature proximity variables stored in a geographic information system were used as model inputs. Combinations of these landscape variables were defined by overlaying the digital maps of drainage class probability and most-likely drainage class. The model drainage class agreed with an Order II (1:20 000 scale) soil survey for 67 % of the study area. A majority of the disagreement was attributed to areas predicted as somewhat poorly to moderately well drained by the model and well drained by the soil survey. This technique consistently assigns soil drainage class based on landscape attributes, documents the data and decision criteria used for drainage class assignment, estimates the uncertainty associated with drainage class assignment, and generates a digital maps for GIS applications.

Bierkens, M.F.P. and Weerts, H.J.T. 1994. Application of indicator simulation to modelling the lithological properties of a complex layer. Geoderma, 62 (1-3): 265-284.

Abstract

This paper describes a three-dimensional simulation of the texture distribution of a complex confining layer. Indicators are used to characterize statistically the spatial variability of the different texure classes. "Sequential indicator simulation" is then used to generate equiprobable realisations of texture classes, conditional on the textures found at the drilling sites. By successively assigning values of conductivities and the porosities to the simulatedf texture classes, fields of conductivities and porosities can be obtained. These can in turn be used as input for a groundwater model in Monte Carlo analysis. A case study is presented to demonstrate the application of sequential indicator simulation to the stochastic modelling of the texture distribution of a complex confining layer in the Netherlands. The results are validated using the data from a lithological cross-section with a very small borehole spacing.

Buchter, B., Hinz, C. and Fühler, H. 1994. Sample size for determination of coarse fragment content in a stony soil. Geoderma, 63(3/4): 265-275.

Abstract

Particle size analysis of soils containing coarse fragments requires sufficient amount of soil material. We tried to quantify the sample volume for coarse fragment measurements in a Rendzina soil with more than 50% coarse fragment content. A monolith of 50 x 80 cm was excavated to a depth of 160 cm, hardened with epoxy resin and cut into six cross sections. The coarse fragment contents were determined on the cross sections by counting the aerial fractions belonging to the fine earth, fine gravel and gravel classes. Additionally, 24 samples with a volume of 3.2 to 4.5 were sieved to determine the coarse fragment content. The contents estimated from the cross sections equalled the content measured with particle size analysis. The data were evaluated in terms of the representative elementary area and volume. The coarse fragment content as a function of the sampling size exhibited the features of the representative elementary colume graph. The side length of the representative elementary area ranged from 11 to 19 cm. The estimated representative elementary volume ranged from 400 to 2100 cm^3.

Crawford, J.W. 1994. The relation between structure and hydraulic conductivity of soil. Europ. J. of Soil Sci., 45(4): 493-502.

Abstract

A random fractal matrix comprising a hierarchical aggregation of primary structural elements is used to capture the characteristics of a heterogeneous soil structure with a tortuous pore space. The influence of hetergeneity of both the solid matrix and the pore space, as well as the shape of the pore boundary, on the saturated and unsaturated hydraulic conductivity is studied. For such random structures, the fractal (Hausdorff) dimension alone is not enough to characterize the structure from the point of view of fluid flow and additional characterizations are introduced. The porosity, r_p, of the primary elements has a critical value, r_c. With probability 1, both the saturated and unsaturated conductivities are found to be independent as a power law on the length scale, L, at which the measurement is made when $r_p > r_c$. When $r_p > r_c$, only the unsaturated conductivity is scaling in length scale, while the saturated conductivity becomes dominated, with probability close to 1, by the conductivity of the largest connecting pores in the structure, i.e. preferential pathways. The relationships between the parameters of power laws and structure are derived and are found to depend on fractal (Hausdorff) and spectral dimensions of the solid matrix, denoted d_m and $\bar{d}$ espectively. A discussion of the importance of these results for the interpretation and extrapolation of measurements is presented, and the implications for variability and predictability of the hydraulic properties of soil is discussed.

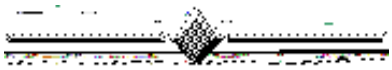
Goovaerts, P. 1994. Study of spatial relationships between two sets of variables using multivariate geostatistics. Geoderma, 62(1-3):

Continued on page 9

93-107.

Abstract

This paper describes a method based on multivariate geostatistics and redundancy analysis for studying spatial asymmetric relationships between two sets of variables. The method involves fitting a linear model of coregionalization to all experimental variables at different spatial scales, and cokriging linear combinations of the predictor variables that account for most of the variance in the set of dependent variables for a given spatial scale. The procedure is illustrated with an analysis of relationships between soil and vegetation variables. Because it takes into account the regionalized nature of the variables, the geostatistical approach allows to distinguish between local relationships and regional relationships due to the presents of different soil types.



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or emailed to:

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PEDOMETRICS '97

August 27-31 1997

First Announcement

The second Pedometrics Conference will be h
University of Wisconsin, Madison from Augus
1997. This leading International Scientific co
in the field of Pedometrics will consist of thre
plenary oral and poster sessions, with two da
excursions and workshops. The program
central topics of:

1. Soil sampling
2. Quantifying pedodiversity/soil
3. Soil Geostatistics
4. Soil landscape and pedogenic m
5. Aggregation and disaggregation (u
   down-scaling)
6. Applications of fuzzy sets

Prospective authors are invited to se
expression of interest to present papers
the areas listed above and/or just to at
conference, by filling and sending the for
to:

Dr Kevin McSweeney,
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University of Wisconsin-Madison
Phone +1 608 262 0331/0380
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I will be attending/ will not be attending
circle)

Accredition ——————————————
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Likely topics of papers (select from nos. 1-

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