ΠEΔOMETRON

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International Working Group on Pedometrics – Provisional Commission on Pedometrics of the International Union of Soil Sciences (IUSS)

www.pedometrics.org

Pedometrics Chair: Gerard Heuvelink **Secretary & Editor: Sabine Grunwald**

1. From the Chair

Dear Pedometricians!

Welcome to Pedometron 15, the second issue of the pedometrics newsletter this year. It looks as if it is becoming a tradition to bring out a Pedometron twice a year: one before summer holidays and one before Christmas. We should thank Sabine for the hard work she has put into preparing the new issue. Please keep on submitting your material so that we can keep Sabine busy and maintain a frequency of two newsletters per year.

The past half year our group has been very active. Several meetings took place and preparations for new meetings are on schedule. In this newsletter you will read more about these and the many other activities taking place. I myself participated in both the Reading and Denver meeting.

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These two meetings and particularly the comparison of the two made me realize that we have - what I would call - a 'problem of our success'. Let me explain what I mean by this. Pedometrics as a discipline in soil science is maturing. Over the years we have developed a body of knowledge that is so extensive that it cannot be learnt in a short time. Also, this body of knowledge is steadily growing. Soil scientists no longer have a choice: they need to specialize in pedometrics if they want to keep up. A participant in the Denver meeting - a broadly skilled soil scientist, always open to new developments - told me that at some point in time he had decided to not attend the pedometrics meetings anymore, simply because he could no longer understand the work presented. This, in a nutshell, is the 'problem of our success': by moving forward we run the risk of becoming estranged from the mainstream soil scientists.

What can we do about it? Do we, in fact, need to do something about it? I think we do, but clearly not by simplifying the content of our pedometrics meeting or by slowing down progress in pedometrics. The series of biannual pedometrics meetings is organized for specialists in pedometrics who present their latest findings, and this should stay that way. But we do want newcomers to attend and we do want to bridge the gap between pedometricians and other soil scientists, so what can we do? Here are some suggestions (surely not all new, surely not complete):

First, we should let our pedometrics meetings be preceded by tutorials and/or workshops, explaining pedometrics techniques on an introductory level. The

wavelet workshop in Reading that we had in September is an excellent example.

Second, we must make sure that we organize special sessions in soil science conferences focusing on *applied* pedometrics (as opposed to *theoretical* pedometrics). The purpose of these sessions should primarily be to offer a broader audience of soil scientists the opportunity to get to know what pedometrics is about. Presentations in these sessions should be understandable to non-specialists.

Third, we should organize workshops that aim to bring pedometricians and other (soil) scientist together to discuss problems and issues that require a contribution from the various groups participating in the workshop. In fact, this idea is already put into practice. Next year we will have the Montpellier workshop on digital soil mapping and a workshop dedicated to the worldwide project will be organized in 2006. Indeed it would be great if we can have such workshops being organized every two years, alternating between the pedometrics meetings.

Fourth, we must produce text books and teaching material dedicated specifically to pedometrics. This is very important, because soil scientists and students that take an interest in pedometrics must have appropriate possibilities to learn about it. Rumors are that two leading pedometricians are working on a pedometrics text book, how timely!

Finally, we must get pedometrics introduced in the soil science curricula of higher education. This is perhaps the most important of all. Our students are the next generation of soil scientists! Ideally, an introductory course in pedometrics should become a standard part of any soil science program. This idea may be the hardest to realize, it really is a long-term goal. Those of us that work in education may try to have their educational systems move in the right direction. I think that the students will be on our side.

These are just some reflections, hopefully providing some food for thought. Please do not hesitate to react, give your opinion and submit it to the next newsletter. After all, we must make sure that we keep Sabine busy!

Gerard Heuvelink
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2. Review Meetings 2003

2.1 Pedometrics 2003

"Pedometrics 2003" was the fifth edition of the Pedometrics conferences organized by what is now known as the "Provisional Commission on Pedometrics" of the IUSS. The conference took place at the University of Reading, UK, between September 11-12, 2003. The local organizing committee was chaired by Dr. Margaret Oliver.

The conference was preceded by a one- day workshop on "Wavelets", given by Dr. Edward Bosch and Dr. Murray Lark. About 15 people participated. This workshop was an excellent initiative, and it might be a suggestion to the organizers of future Pedometrics conferences to plan a similar workshop. There is quite some demand for hand-on training on a number of Pedometrical techniques.

The conference itself started on Thursday September 11 by a welcome address given by Prof. Stephen Nortcliff, Secretary General of the IUSS who is a colleague of Dr. Margaret Oliver at the University of Reading. He pointed to the large industry of the members of the Provisional Commission on Pedometrics and the importance of Pedometrics to Soil Science.

Then the scientific activities started, organized as 4 sessions:

- New development and applications in Pedometrics.
- Multivariate methods, including space/time applications.
- What can Pedometricians offer in the field of contaminated land?
- Methods that span the soil, water, agriculture interface.

In total 30 oral contributions were presented, spanning a wide range of methods, approaches and viewpoints. Pedometrics is continuing to embrace an increasing number of topics, which is very positive.

The first three sessions were closed by a poster session during which the poster authors were asked to present their poster in 5 minutes in front of the conference room. This proved to be an ideal way to

transfer efficiently the contents of each poster to all participants.

At the conference dinner, Prof. Stephen Nortcliff gave an entertaining speech, in which he congratulated again the Pedometrics community as being one of the most active groups within the IUSS. He also expressed his hope, and belief, that our Provisional Commission will become a Commission soon. The final decision will be taken at the mid-conference meeting in Philadelphia in 2004. Also during the conference dinner, the outcome of the voting on the two Best Papers in Pedometrics for 2001 and 2002 was made public and the authors received a certificate. One of them was Alex McBratney who initiated this award in 1992.

In total some 60 people participated which is somewhat less than at the previous conferences, but I am sure that they all returned home enriched with new ideas and new contacts. All contributors were asked to submit their presentation as a paper which will be evaluated to be published in a special issue of Geoderma.

The last words of this report are directed to Margaret Oliver. As we all know this was her last international activity as an active academician, since she retired from the University of Reading at the end of September, 2003. Therefore, during the conference dinner, Dr. Gerard Heuvelink honored her as a Pedometrician and praised her large number of influencing publications. As a recognition, she was offered a very nice book with aerial photographs taken from all over the world and all participants of Pedometrics 2003 were asked to sign it.

Thank you Margaret, for organizing Pedometrics 2003 so well and for leading the way for so many of us during so many years !

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2.2. Special Topics Session "Advances in Thematic Soil Mapping" at the ASA-CSSA-SSSA Meeting

This Special Topics Session was part of the Division S-5 Pedology sessions held at the Annual American Society of Agronomy (ASA) - Crop Science Society of America (CSSA) - Soil Science Society of America (SSSA) Meeting in Denver, Colorado, USA from November 2-6, 2003. The Special Topic Session was jointly organized with the Pedometrics Working Group. The theme of the session was "Emerging Soil Mapping Techniques" bundled in one oral session with 10 presentations and a poster session with 14 presentations. All sessions were very well attended. Topics ranged from space-time modeling, uncertainty assessment, spectroscopy, co-kriging, GIS-based soil mapping and stochastic simulation methods to name only a few. A vivid discussion developed after the oral presentations which addressed the impact of emerging techniques such as rapid data collection and statistical and geostatistical techniques on soil mapping. The special topic session was coordinated by Dr. Achim Doberman, University of Nebraska and Dr. Sabine Grunwald, University of Florida. We thank all authors who contributed to the success of the special topics session.

In the business meeting of Division S-5 Pedology SSSA trends in dropping membership were discussed. Like last year we submitted a proposal entitled "Linking Pedology to Pedometrics" to volunteer to organize a S-5 symposium at the next SSSA meeting in Seattle, WA. Unfortunately, our proposal was turned down again. Other competing proposals for a S-5 symposium in 2004 included:
(i) Volcanic soils, (ii) Lewis and Clark, and (iii) U.S. vs. Canadian/Russian Soil Classification Systems.

Sabine Grunwald
Secretary PWG

3. Best Paper Awards

Excellent papers were nominated for the Best Paper Award 2001 and 2002. A selection was difficult because all papers were unique in their contribution to pedometrics. Members of the Pedometrics Working Group voted for the following papers at the Pedometrics Meeting in Reading, UK. Congratulations to the authors!

Award 2001

Minasny, B. and McBratney, A.B., 2001. A rudimentary mechanistic model for soil production and landscape development II. A two-dimensional model incorporating chemical weathering. Geoderma, 103: 161-179.

Award 2002

Bogaert, P., D'Or, D., 2002. Estimating soil properties from thematic maps: The Bayesian Maximum Entropy approach. Soil Science Society of America Journal 66, 1492-1500.

Fig. 1. Dr. Stephen Nortcliff, Secretary-General IUSS, stepping into the footsteps of his predecessor Dr. Blum most famous for wearing a bowtie.

Fig. 2. Poster presentations at the Pedometrics 2003 meeting.

Fig. 3. Participants of the Pedometrics 2003 Meeting in Reading, UK.

Fig. 4. Dr. Margaret Oliver and colleague.

Fig. 5. What are they talking about ….. at the conference dinner.

4. Survey of Pedometrics

Pedometrics (PM) as a scientific community has been active now for more than a decade. However, no systematic survey has as yet been conducted on which are the most important PM topics and how many thematic sub-groups there are. This information is not only of interest for the PM members, but also for the broader scientific public that might be interested in pedometrics. This survey gives an overview of PM members and topics, an insight into their relationship with other general sciences and into the heterogeneity of the PM community.

The specific purpose of this survey was to establish the most important applications and topics in the area of pedometrics and help PM members to find potential collaborators. We listed 20 methods/tools and 20 applications, based on a list of most recent publications in PM, and forwarded them to all PM members (pedometrics mailing list). The respondents were asked to select a maximum of three topics in the methods/tools category and three in the applications category (or suggest some missing topics) that are the most relevant to their current work and post their answers to the PM website administrator.

We got 14 replies by e-mail and 24 at the PM 2003 conference in Reading (from the total of 59 participants). We also estimated topics for some established pedometricians from their most recent papers. Hence, the total number of PM members included in the analysis was 53.

METHODS/TOOLS

1. (Co-)Kriging techniques
2. Bayesian maximum entropy
3. Digital terrain analysis
4. Electrical conductivity and gamma radiometrics
5. Expert (knowledge-based) systems
6. Fractal theory
7. Fuzzy sets theory
8. GAM and regression tree models
9. GIS and soil databases
10. GLM, REML mixed models and multivariate statistics
11. GPS and mobile GIS
12. Kalman filters
13. Neural networks
14. Multivariate geostatistics (KED, RK, UK)
15. Pedotransfer functions
16. Precision agriculture equipment
17. Remote sensing and airborne images
18. Simulations and error propagation
19. VRML models
20. Wavelet analysis

APPLICATIONS

1. 3D visualization of soil bodies
2. Civil engineering projects
3. Economics of soil data
4. Erosion modelling
5. General-purpose soil mapping
6. Land evaluation and Land use planning
7. Mapping of soil pollutants
8. Multisource data integration
9. Plant nutrition and soil management
10. Precision agriculture
11. Quality assessment of soil data
12. Regional and global environmental modelling
13. Sampling and sampling designs
14. Soil classification
15. Soil Information Systems
16. Soil microbiology
17. Soil physics
18. Soil-genesis simulations
19. Spatio-temporal prediction
20. Uncertainty and decision making

The most relevant topics in PM

From the list of 40 topics, (co)kriging, multivariate geostatistics, GIS and fuzzy sets are the tools used most often, while most of the PM members selected spatio-temporal prediction, general soil mapping, soil-plant nutrition and mapping of soil pollutants as their key applications (Fig. 1). Note that the selected applications were much more equally distributed than the tools/methods. From the 40 topics listed above, only a few (VRML models, Civil engineering projects, Economics of soil data and Soil microbiology) were selected only once or not at all. Similarly, only few respondents added a new topic. This indicates that the initial list of topics was sufficiently exhaustive.

Find your potential research partner

Table 2 presents an association matrix between all respondents based on the selected topics. Shaded cells represent the most strongly associated respondents, i.e. the ones that have 4, 5 or 6 topics in common. In most cases, there are 4 to 7 members that selected 3 or more topics that are the same. Some respondents (Oliver, de Gruijter, Goovaerts, Monestiez, Lark, Voltz) seem to have a broad interest and are active in a variety of sub-fields, because they are strongly associated to 10 or more members. Other members (Bierkens, Bosch, Guix, Savelieva, Triantafilis) seem to operate relatively isolated from other members. This was also confirmed in the following analysis (Fig. 3).

This information can now be used, for example, to refine the current definition of PM. From the topics selected above, PM can be defined as:

"Application of spatial statistics for the purpose of spatio-temporal modelling of soil data. It especially focuses on soil survey, precision agriculture applications, mapping of soil pollutants and other environmental applications."

This is a more detailed definition than the general definition of pedometrics, which simply states that PM is "the application of mathematical and statistical methods for the study of soils".

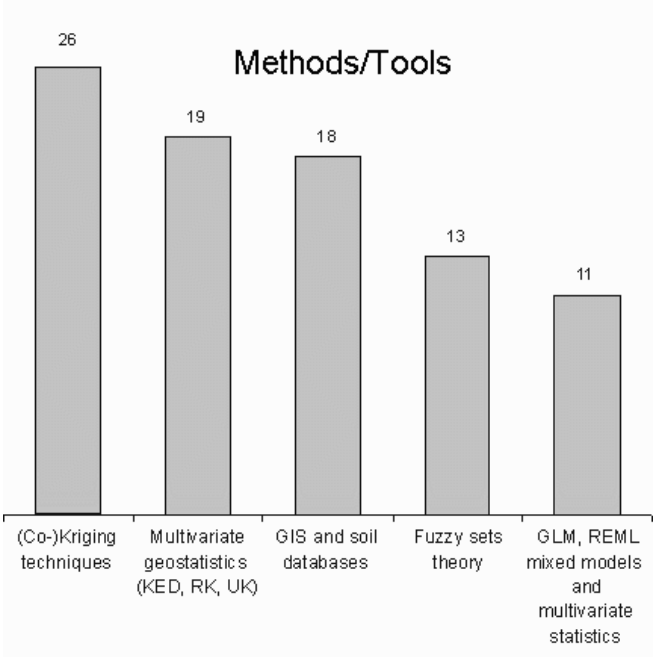


Fig. 1. Ten most frequently selected methods/tools.

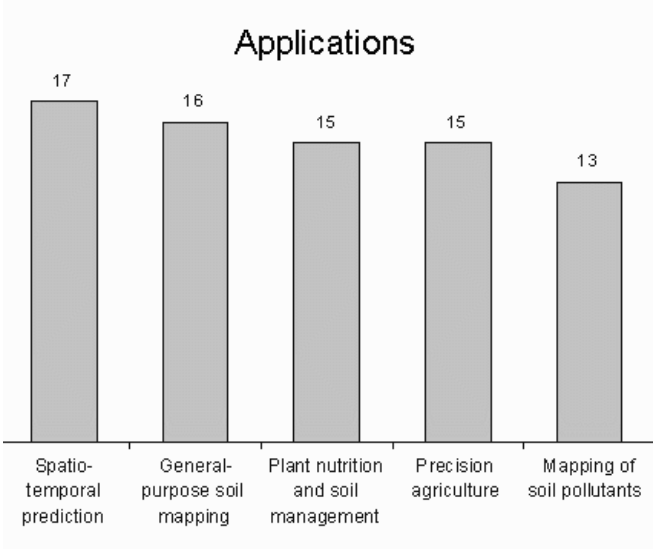
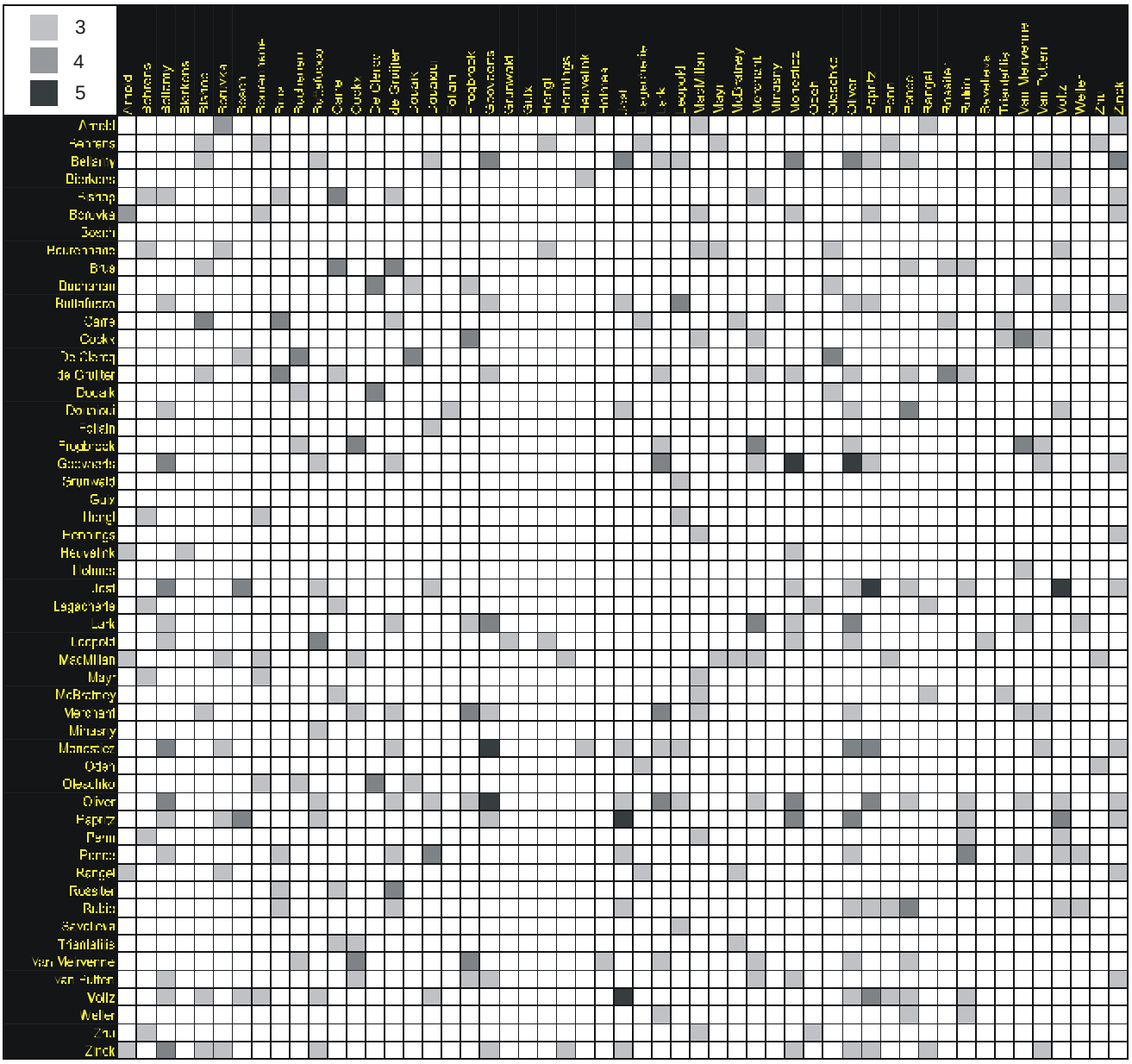


Fig. 2. Ten most frequently selected applications.

Table 2. Association matrix showing the most congenial PM members. Legend indicates the number of topics selected by both respondents.



The 53 respondents were also clustered into 3 clusters using the k-means clustering algorithm of S-plus, using 39 topics as variables (one topic was dropped out since nobody selected it). The clusters were of size 24, 14 and 15 (see below). Because k-means clustering also finds automatically the class centres, these can be used to recognize which topics are related to which class. In Table 3, the three clusters of PM members are given, together with associated topics (with high membership values - close to 1).

Table 3. Three clusters of PM members extracted using k-means clustering with associated PM topics.

Clusters	Cluster A	Cluster B	Cluster C
Related topics	Kalman filters, Multivariate geostatistics, Soil physics	(Co-)Kriging techniques, Precision agriculture equipment, Mapping of soil pollutants, Sampling and sampling designs	Fuzzy sets theory, General purpose soil mapping
PM members	Bierkens, Bosch, Bourennane, Buchanan, Buttafuoco, De Clercq, Douaik, Douaioui, Follain, Grunwald, Hengl, Heuvelink, Holmes, Jost, Leopold, Minasny, Oleschko, Papritz, Penn, Ponce, Rubio, Savelieva, Voltz, Weller	Bellamy, Bishop, Brus, Cockx, de Gruijter, Frogbrook, Goovaerts, Lark, Merchant, Monestiez, Oliver, Van Meirvenne, Van Putten, Zinck	Arnold, Behrens, Boruvka, Carre, Guix, Hennings, Lagacherie, MacMillan, Mayr, McBratney, Odeh, Rangel, Rossiter, Triantafilis, Zhu

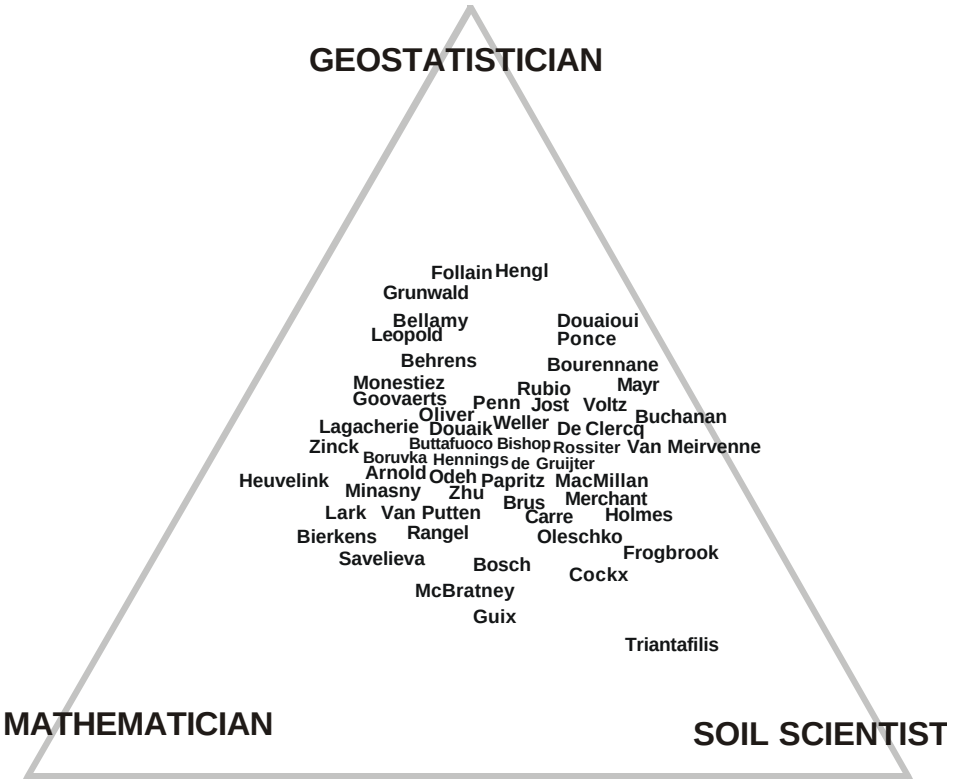


Fig. 3. Are you are a PM-mathematician, PM-geostatistician or a PM-soil scientist? The position in the triangle is calculated using the membership of the selected topics to each of the three main profiles.

To which profile do you fit the best?

The respondents were sorted according to the connection with the typical profile of a PM member. Here we assume that there are three main profiles for a PM-member: PM-mathematician, PM-geostatistician and PM-soil scientist. For each topic we estimated the membership of belonging to a certain profile and then calculated the average membership for each member and for each of the three profiles. For example, topic "Fuzzy sets theory" was assigned a membership value of 0.2 for PM-geostatistician, 0.7 for PM-mathematician and 0.1 for the PM-soil scientist profile.
The final results (triangle) are given in Fig. 3. Although most of the members seem to have a truly interdisciplinary profile, it is also clear that some members belong more to the profile of geostatisticians (Hengl, Follain, Grunwald, Bellamy), some belong to the profile of soil scientist (Triantafilis, Frogbrook, Cockx) or the profile of a mathematician (Heuvelink, Bierkens, Lark, Savelieva). Also note that, in general, the cloud of the PM members is somewhat shifted towards the upper-right part of the triangle. This means that geostatistical and soil science topics are prevailing among PM members.

Disclaimer: The authors would like to emphasize that subjective decisions have been made in many parts of this analysis (e.g. initial selection of topics, estimation of topics for members that have not filled the forms, appointment of the memberships etc.). You might not agree with the list of topics and distribution of fuzzy memberships. Consequently, you might not agree with your position in the correlation matrix or in the PM triangle. It is entirely up to the reader how to interpret and use these results. In other words: do not treat these results too seriously, it is mainly meant to entertain!

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5. Worldwide IUSS Project Open Letter

Building on the strengths of previous IUSS commissions and working groups, the worldwide project, that the title of this letter refers to, provides timely and important over-arching objectives capable of being fulfilled by the world community of soil scientists in the IUSS. The first objective is to initiate and sustain a worldwide multidivisional project to accelerate the development of appropriate spatial and temporal soil inventories that match local and regional crop production requirements. The second objective is to cooperate with the International Council for Science (ICSU) and other international organizations and agencies for combating food insecurities in all nations.

Mapping our earth's soil resources has been a continuing effort even before the creation of the ISSS. And with the advent of remote sensing, computers, a huge number of instruments recently designed for measuring soil and environmental properties, and an enlightened awareness of sustaining the quality of our environmental recourses, several working groups of ISSS and IUSS have focused their efforts on GIS, digital soil data bases, soils and global change, etc. Note that the worldwide project approved in Bangkok at the IUSS meeting applauded and encouraged the efforts made by the IUSS Working Group on Global and National Digital Data Bases on Soil and Terrain Conditions in cooperation with FAO and other international organizations. We envisioned that the members of the WG together with many others will continue and accelerate that and other related programs and activities. Although there are many soil scientists being members of different commissions of all four of the newly formed IUSS divisions contributing research and information potentially applicable to increasing world food resources and their security, their collective efforts are not universally focused on a unique, paramount objective such as the first objective of the worldwide project. The introduction of new high-yielding crops, inputs and practices into food insecure regions of the worlds is constrained by lack of local soil resource inventories of adequate scale and quality. New, cost-effective and rapid methods for making soil inventories are available and need to be tested for widespread application in food insecure regions of the world. For quick impact on food production, soil resource inventories must contain the minimum data set required by simulation models to screen new crops,

optimal inputs and conservation practices for adoption by farmers. The capacity to match crops and practices to soil and weather conditions is made possible through crop simulation models contained in decision support tools. Several such tools developed in Europe, Australia and North America have been especially designed for use in data sparse regions of the world, and depend on a minimum set of soil, crop and weather data.

The Pedometrics Commission is in an excellent position to provide new technical methodologies and scientific leadership for the worldwide project accelerating the development of appropriate spatial and temporal soil inventories that match local and regional crop production requirements. The Pedometrics Commission stems from several WG of IUSS held in 1978. Now, 25 years later, the Pedometrics Commission is a brand new concept of soil science with a worldwide membership specializing in the application of mathematical and statistical methods for analyzing and modeling soil distribution, properties or behavior.

I am asking the Pedometrics Commission, "Do you wish to be involved and take a leadership role in the worldwide project of IUSS? It is a challenge for all of us, and a fantastic opportunity for the profession of soil science and other earth sciences. If you accept, you shall be on the ground flood of its development, proposed activities and scheduling of events, especially for the first objective. I envision a few case studies to be initially made in selected food insecure regions of the world to estimate soil data at unsampled locations from known values at a yet-to-be-determined minimum number of neighboring sites. The capacity to match crops and farming practices with soils and weather conditions, in conjunction with economic policies set by local governments would be made possible through crop simulation models, and where possible be compared with measures of farm production.

Through your newsletter Pedometron, and the various web sites of each of the national soil science societies and the IUSS office as well as email linkages to individual soil scientists, communication and level of interest should be relatively quick and effective. Sampling designs, experimental field observations, statistical analyses, and related matter could be easily sent on the Internet between individual scientists and organizations without excessive paper work and reporting protocols. Monetary resources for each of the case studies will need to be obtained from regional to international agencies and foundations.

I am eager to receive your initial comments and suggestions.

Sincerely,
Donald R. Nielsen
Chair, US National Committee of Soil Science
drnielsen@ucdavis.edu

Response from PWG
Dear Don,

At the recent Pedometrics meeting in Reading we discussed your proposal to become involved in the IUSS project on 'Soil Inventories for Combating Food Insecurity'.

We are very positive about this initiative and would very much like to play an active role in it. This is a timely proposal that is important to the world community. It is also important for soil science because it demonstrates how important soil science is for solving world-scale problems.

We agree with you that pedometrics can and should play a leading role in delivering and help testing techniques and methodologies for making soil inventories that sustain crop production in the developing world.

In Reading we also discussed what actions we, as a working group in pedometrics, can undertake to support the project. This resulted in three specific activities:

1. Next year we will hold a workshop on Digital Soil Mapping in Montpellier, France. The key goal of the workshop is to review, discuss and help develop new, rapid and economic methods for digitally mapping soil classes and attributes (and their uncertainties). These kind of rapid and economic methods are particularly

needed for the developing world. Clearly there is much overlap between the goal of the worldwide project and that of the workshop. We are putting a lot of effort into making the workshop a success. The workshop is chaired by Philippe Lagacherie.
Our plan is to draw attention to the worldwide project at the workshop, by putting it up as a theme for discussion during one of the sessions. This should generate a lot of ideas on how to tackle the problems identified within the project.

It would be ideal if you could introduce the worldwide project at the workshop in Montpellier yourself. We sincerely hope that you will be able to attend the meeting. It would really be an excellent opportunity to bring the project to the attention of a larger group of soil surveyors and pedometricians. These are the people that need to develop and apply the appropriate spatial and temporal soil inventories and we expect many ideas from them.

2. We will organize a workshop on the 'Development and Application of Soil Mapping and Monitoring Methodologies to Support Crop Production (Studies) in the Developing World'. This is a working title, but let it be clear that this workshop will specifically focus on the worldwide IUSS project 'Soil Inventories for Combating Food Insecurity'.

We need to work out all of the details of this workshop, but some things have already been decided. The workshop will be organized around May/June 2006 (so that we can report on the outcomes at the 18th World Congress of Soil Science, July 2006). The workshop will be held in a developing country. There must be a fair number (50 per cent) of participants from developing countries, for this we need to seek external funding. The chair of the organising committee will be Alex McBratney (alex.mcbratney@acss.usyd.edu.au).

3. We want to bring the worldwide IUSS project to the attention of all members of our working group. This can best be done through our newsletter, Pedometron, as well as through our website, www.pedometrics.org.

The result of the Reading meeting thus is that we accept to play an important role in the worldwide IUSS project 'Soil Inventories for Combating Food Insecurity'. We also generated some very specific ideas to help make this project a success.
We look forward to your reply.

Best regards,

Gerard Heuvelink (chair) & Sabine Grunwald (secretary), PWG

6. The Definition of Pedometrics

In previous Pedometrons we initiated a discussion on what would be the 'best' definition of pedometrics. In Pedometron 13 we asked you, the reader, to submit your suggestions for THE definition of pedometrics. These suggestions were added to the existing ones, which resulted in a total of 13 candidate definitions, published in Pedometron 14. We then asked you to respond to this list by selecting from it those that you liked best. Although the response to this call was not overwhelming (in total 10 respondents, including myself!), I do believe that the outcome reflects the opinion of the majority of pedometricians (let's just say that the respondents formed a 'representative' sample from the population of pedometricians).

Let me now reveal the final (definitive, discussion closed) result.

Third in ranking ended a very straightforward definition of pedometrics, which is attractive because it captures the very essence of our work in just a few words:

Pedometrics = the application of mathematical and statistical methods for the study of soils.

Second in ranking was a somewhat more elaborate definition, providing more information and stressing that we deal with quantitative modelling of soils:

Pedometrics = the application of mathematical and statistical methods for the quantitative modelling of soils, with the purpose of analysing their distribution, properties and behaviour.

The winner is a definition that is in between the two above (at least in length). It underlines that we are mainly interested in studying the distribution (in space, time and attribute space) of soils, and in their genesis:

Pedometrics = the application of mathematical and statistical methods for the study of the distribution and genesis of soils.

I propose that from now on we will be using this winning definition of pedometrics in our (formal) correspondence and communication as a (provisional) commission of pedometrics. Of course we will not (and cannot) enforce that each pedometrician uses this and only this definition in all cases. But please consider it. If we all stick to the same definition then this will increase the recognisability and visibility of pedometrics as a well-defined discipline within soil science.

Gerard Heuvelink

7. Activities in Progress

We collected suggestions for symposia organized by the PWG - World Congress of Soil Science "Frontiers of Soil Science – Technology and the Information Age" in Philadelphia, Pennsylvania July 915, 2006. From these suggestions we hope to realize one or two symposia, decisions will be made early 2004.

(1) Soil (Data -> Information -> Knowledge -> Wisdom)

(2) Pedodiversity

(3) Soil genesis and soil survey: more quantitative understanding through more quantitative approaches

(4) Image analysis for soil science

(5) Soil sampling ins space and time

8. Textbook Reviews

Everitt, B.S., 2002. The Cambridge Dictionary of Statisics. 2nd edition. Cambridge University Press, Cambridge, UK. 410 pp. ISBN 0 521 81099. PRICE $75

I am an unashamed lexicanagnostophile, and because I am, and I could not find a word to describe my penchant, I made one up. Lexicanagnostophiles *love to read dictionaries*. (Those with some knowledge of ancient Greek will be able to follow the etymology.) So it was with a certain relish that I took up Everitt's Cambridge Dictionary of Statistics and read – no random or stratified sampling - just systematic, cover-to-cover, complete enumeration.

Everitt is one of the most prolific book authors in statistics. We get the full five-day twenty-city European tour of statistics in just 410 pages and some 3000 entries. We get more than the five-day, twenty-city European tour of statistics. We really do get an appreciation of the length and breadth and depth and other dimensions of modern statistics. The entries lie somewhere between the normal dictionary entry and those of an encyclopedia. They consist of one to several paragraphs along with equations where appropriate. I believe this is where this kind of dictionary I believe is superior to a language dictionary because the great abstract power of words, symbols and equations set side by side combine synergistically.

So for those pedometricians who want to quickly catch up with modern statistical then definitions such as, **Generalized estimating equations (GEE)**, **Markov chain Monte Carlo methods (MCMC)**, **Residual maximum likelihood estimation (REML)** and **Wavelet analysis** will be instantly explained to you and will set you on the path to enlightenment. These are **the** techniques of the moment. There are some other delightful entries. I include a couple here to give the flavor of the dictionary.

Head-banging smoother: A procedure for smoothing spatial data. The basic algorithm proceeds as follows:

- for each point or area whose value y_i is to be smoothed, determine the N N nearest neighbors to location x_i
- from among these N N neighbors, define a set of points around the point area, such that the

'triple' (pair plus target points at x_i) are roughly collinear. Let NTRIP be the maximum number of such triplets

- let (a_k, b_k) denote the (higher, lower) of the two values in the *k*th pair and let *A* = median{ a_k }, *B* = median{ b_k }
- the smoothed value corresponding to y_i is $\tilde{y}_i$ = median{*A*, y_i, *B*}. [*IEEE Transactions on Geosciences and Remote Sensing*, 1991, **29**, 369-78.]

No free lunch theorem: No one thing is optimal with respect to everything. [*Complexity*, 1996, **1**, 40-46.]
I don't know if I can advocate head-banging for pedometricians. The latter theorem is certainly a large part of the struggle for a sensible soil quality definition In these days of diminished budgets, the **Secretary problem** is not one we have to worry about any longer. You will have to read the book to find out about Galton's **Quincunx** – it's more than the five-spotted domino. It's a physical model of a statistical process as opposed to a statistical model of a physical process.
From reading the dictionary one forms a view that soil science, in particular pedometrics, seems to have had a minimal impact on statistics this far – a clear challenge. The only entry that directly relates to soil science is the **Rothamsted Park Grass experimentExperiment**. Interestingly, its more famous near neighbour, Broadbalk, doesn't rate a mention. There are other Rothamsted-related entries, e.g., **Gower's similarity coeffiicentcoefficient**, but it isn'tis not explained that it was devised to compare soil profiles, described by a mixture of continuous and categorical variables, in the early 1960s at the request of the late James (J.H.) Rayner – an early and substantial contributor to pedometrics.

Unlike our recent dictionaries of soil science (Lozet and Mathieu, 2002; Gregorich et al., 2002) recent *French one, Alfred please add reference*) this contains entries on statisticians people who have made major contributions. The only other criterion is that they have to be dead, so I'm not sure if today's great statisticians are queuing up to get into the book. A similar idea for soil science dictionaries would be useful however. I learned from this that statistical graphics was invented by the Scot, William Playfair around 1786, and R.A. Fisher the genius of modern statistics (the not-so beloved of generations of ag. students in agriculture) emigrated to Australia in 1957 at the age of 67 – so it's not too late for most of you.

There are some typos and some of the entries I couldn't even begin to understand (I've still got no idea what **Fiducial inference** is about – can anyone help?), and perhaps there is a slight bias towards medical statistics. These are minor complaints. It has been remarked to me that lexicanagnostophiles love big dictionaries. This is not a big one, but nevertheless I found it very satisfying. It has a place on the shelf of all budding and flowering pedometricians.

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References

Lozet, J. and Cl. Mathieu, 2002. Dictionnaire de science du sol (4th edition). Lavoisier, Paris, 575 pp.

Gregorich, E.G., L.W. Turchenek, M.R. Carter and D.A. Angers, 2002. Soil and environmental science dictionary. CRC Press, Boca Raton, 577 pp.
Dictionary of soil science

Eswaran, H., Rice, T., Ahrens, R. and Stewart, B. A. (editors)

SOIL CLASSIFICATION - A GLOBAL DESK REFERENCE.

CRC Press, Boca Raton, FL, 2002. XIV + 263 pp. US $ 99.95, hardback, ISBN 0-8493-1339-2.

The main part of this book are eleven chapters of nearly 200 pages describing in some detail the current developments of soil classification systems in Australia, Brazil, China, France, New Zealand, Russia, South Africa, USA, in addition to a discussion of the World Reference Base (WRB), the FAO World Soil Map Legend, and some issues related to the use of the

USDA Soil Taxonomy. The wide geographic extent presumably justifies naming the text 'a global desk reference'. All the new classification systems base themselves on the two principles elaborated since 1960 in the USDA Soil Taxonomy – that actual properties, especially of the major diagnostic horizons are the basis of classification, and that quantitative limits of observed features (rather than 'modal values') are used to evaluate them. Even though the new Chinese classification calls itself genetic, and the new Russian classification is called 'profile-genetic' - meaning that pedogenetic concepts have been used in the recognition of the diagnostic horizons - the designation and consistent use of diagnostic horizons is the major and widely followed innovation of the USDA Soil Taxonomy in modern soil classification. The historical development of classification concepts is treated mostly very briefly. The French contribution is exceptional in that it uses the approach of 'pedological systems' where the differentiating features are spatial sequences (soilscapes) of the pedological cover complementing taxonomic inventories. It is devised to better understand the spatial distribution of soils in the landscape.

Part 1 of the book contains eight short and thoughtful presentations of different schools of reflection and conceptual discussions of certain aspects of soil classification - by Stan Buol, Rudi Dudal, Robert Ahrens and Thomas Rice, Richard Arnold and Hari Eswaran, Winfried Blum and Michiel Laker. Johan Bouma suggests that we should stop further modification of current taxonomies and use dynamic computer simulation models, while Ray Bryant and John Galbraith suggest to incorporate more anthropogenic features and processes. Goro Uehara hopes that studying amorphous materials will become important, also for classification.

There is no doubt that the lack of an accepted universal classification has retarded the progress of pedology to a great extent, especially in our communication with colleagues from related sciences. We now have two major systems (WRB and USDA Soil Taxonomy) that seem to put in the claim of more or less worldwide acceptance. WRB is not likely to expand much into the lower levels of the classification hierarchy. Soil Taxonomy is continuously developing. So do we request the USDA to reconstitute the Soil Management Support Services or some other aid project so that it can expand the data and monitoring base and at the same time instruct developing countries how to use Soil Taxonomy and Soil Survey? What is the advise on the use of soil classification we wish to give to small countries? Should they continue to develop their own national classification as well?

It is of course easy to proclaim in hindsight that several important points have been covered too vaguely or not at all. I would have liked it to be pointed out more clearly that because soils are dynamic open systems, a classification always represents only a snapshot in time, especially now with rapid environmental and human induced changes. The lower depth of soil descriptions is a weak point in data collection and has not been considered sufficiently in any classification. The relation of soil mapping and soil classification has not been explored in depth. These are weighty questions which need to be discussed in future symposia.

Almost all authors either cite the classical Marlin Cline papers or The Guy Smith Interviews on their statement that soil classification (like all classifications) are human contrivances made to organize better a wealth of material for a specific purpose and to improve communication between scientists and with the general public. For me the greatest surprise in this volume is the last sentence by the four editors in the Preface; "…it is only when the global science community agrees to such a [soil classification] system that we can truly say that we have a science." Soil Classification as an icing on the pedological cake? Certainly not. A good usable classification is important, but does not make pedology a science. Merely a practical tool for defined purposes. Taxonomies are dynamic and open to revision or expansion. Thus future similar volumes are probable. The presence of this book in all soil departments and their libraries is highly recommended.

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9. Upcoming Meetings

International Environmetrics Society & Symposium on Spatial Accuracy Assessment
http://www.ncrs2.fs.fed.us/4801/meetings/ties/default.asp in Portland, Maine June 28-July 1, 2004.

Global Workshop on Digital Soil Mapping

Eurosoil
http://www.forst.uni-freigburg.de/eurosoil/
in Freiburg i. Brsg., Germany Sept. 4-12, 2004 (abstracts due Dec. 31, 2004)

Geostats Congress
http://www.geostats2004.com/
in Banff, Alberta Sept. 26, 2004

Organized by the International Working Group on Pedometrics – Provisional Commission on Pedometrics of the International Union of Soil Science http://sol.ensam.inra.fr/DSM2004 in Montpellier, France, September 15-17, 2004
(abstracts due Jan. 1, 2004)

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Pedofract
Fractal Mathematics Applied to Soils and Related Heterogeneous Systems.
http://www.itc.nl/personal/hengl/PM/WEB/PEDOFRACT_2004.htm in El Barco de Avila, Spain July 2- 6, 2004