ΠΕΔΟΜΕΤRON

The Newsletter of the Pedometrics Commission of the IUSS

Issue 27, August 2009

Chair: Murray Lark *Vice Chair & Editor: Budiman Minasny*

From the Chair

Dear Colleagues,

Welcome to this special issue of Pedometron, published to mark the biennial Pedometrics conference which this year takes place in Beijing. I trust that we shall have a fruitful meeting, the first in this series to take place on the continent of Asia.

There have recently been moves afoot among evolutionary biologists to stop speaking of 'Darwin's theory of evolution' and, instead, to call it 'Darwin's law of evolution'. This is to stymie creationists who like to say 'evolution is only a theory'. Now I am all in favour of stymieing creationists, but I think that this idea is misguided. The underlying assumption is that the use of the word 'Law' is best explained by thinking of it as sitting on a scale of certainty such that Law >> Theory > Hypothesis >> Wild bath-time speculation. I am not convinced that this is true.

Richard Feynman was one of the great physicists of the 20th century, but when giving the lectures that make up his brilliant *Nature of Physical Law* he turned to the 18th century and Isaac Newton for the *locus classicus* of a scientific law. We all know how Newton, escaping from the plague to the countryside, was allegedly struck by a falling apple. According to the popular account he asked 'why did the apple fall?', and promptly invented his law of universal gravitation. As a schoolboy I was perturbed that studying Newton brought me no closer to an understanding of why the apple fell. Actually Newton's insight was different. He recognized that some simple mathematical axioms could provide an account of the motion of a falling apple, the motion of the moon around the earth and the motions of planets around the Sun. Nothing new needed to be invoked when changing scale from an orchard to the Solar System. This is why Newton faced opposition from contemporaries, such as Leibniz. They thought in scholastic terms, and did not consider that an advance had been made in knowledge unless an efficient cause had been uncovered. From now on scientific knowledge was to be different.

If we invoke Newton we do not set out to explain why the apple falls, but instead we show how the simple axioms of the law can be expanded into a wide-ranging set of explanations of, apparently, disparate phenomena. Why the apple falls is an excellent question, for another day.

Now I don't think that Darwin's theory ever had, or could now have, this particular status. One can deduce a lot from the principle of natural selection, but it is not a starting point or axiom. Darwin actually started from some other axioms — a law that organisms tend to inherit traits from their parents and a principle (from Malthus) that living things are in competition for the limited resources which they need to survive and breed. The theory of evolution by natural selection rests on these more fundamental phenomena which by Darwin's time were sufficiently well-understood for him to use this way (we understand them much better now, of course, and the inheri-

Inside This Issue

tance of traits is no longer a law of biology, it rests on more fundamental cell biology and chemistry). Biologists do not always get this, which explains the curiously naive comment by Richard Dawkins in Unweaving the Rainbow that the law of least action is 'not entirely satisfying as an ultimate explanation' of the phenomena that it describes.

Now an obvious question is whether there are any laws of pedometrics. By a law, to recapitulate, we mean some simple axiomatic statement from which we can unfold a number of different and useful results. In some respects the assumption of intrinsic stationarity is such a law. It is, essentially, untestable, although its plausibility may be assessed. The idea that soil variation can be treated as fractal is another law, and one that certainly has been unfolded into conclusions in pedology and physics; but, to say the least, it is creaking a little. I recently asked one fractal practitioner what the main thing is that fractal analysis of soil has taught us. 'That the soil is not fractal', was the candid answer.

Another possible law is analogous to a law of ecology, the species–area relationship of island biogeography by which the number of species on an island depends on its area. Some recent papers in the soil literature have suggested that such a relationship might hold for soil types. This might turn out to be fruitful, but I have two reservations. First, MacArthur & Wilson (1967) suggested that observed species–area relationships might be directly deducible from a (truncated) log-normal distribution of the relative abundance of species. If so, then the underlying law might be this distribution, which would be easier to test than number/area relationships. Second, some attention (rightfully) has been given to the CSIRO report written by Philip Beckett and Stein Bie in 1978 on the basis of their earlier visit to assess soil survey practice in Australia. Beckett and Bie plotted the log of the number of soil classes from different surveys (at various levels) against the log area of the survey. However (and some who have cited this report as the first study of the phenomenon have passed over this) they specifically decline to compare the relationship to the species–area relationship in island biogeography because the soil classes tended to be conceptually broader in surveys of large areas (so are not comparable to species). They also reported that the evidence for a relationship between number of classes and area (on log-log scales) was weak — R^2 values of 0.33 and 0.39.

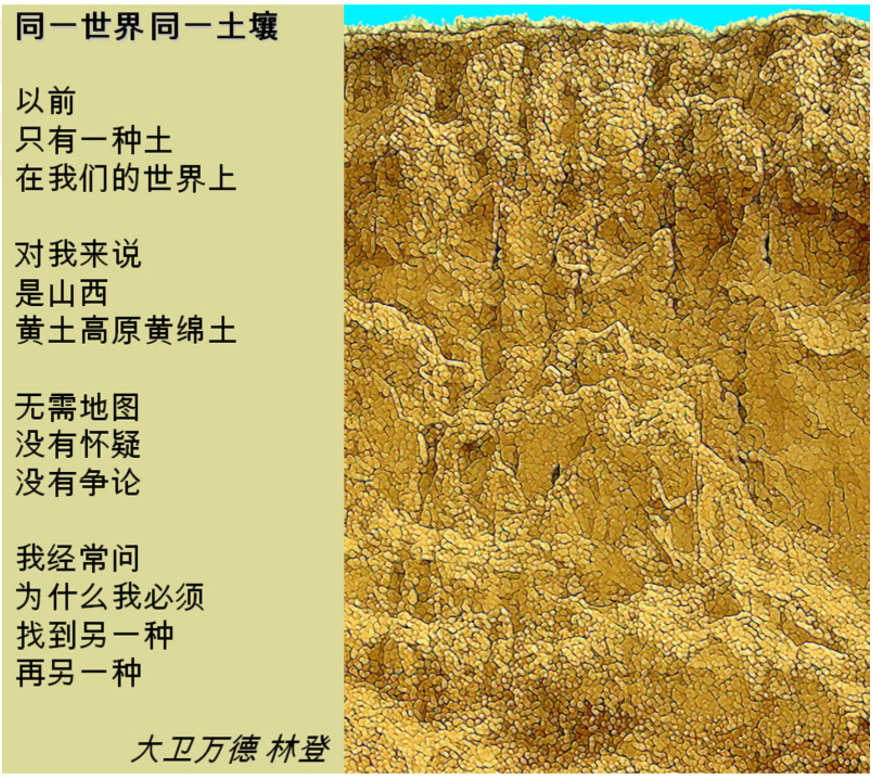
May I take this opportunity to thank Yuanfang Huang and his colleagues at China Agriculture University for organizing Pedometrics 2009, to welcome all delegates to the meeting, and to greet our colleagues who are unable to attend.

With best regards

Murray

Beckett, P.H.T. & Bie, S.W. 1978. Use of soil and land-system maps to provie soil information in Australia. Division of Soils Technical Paper No. 33. CSIRO.

MacArthur, R.H. & Wilson, E.O. 1967. The theory of island biogeography. Princeton.



One World One Soil by David van der Linden

The Richard Webster Medal:

an award by the Pedometrics Commission of the International Union of Soil Sciences

The Richard Webster Medal: an award by the Pedometrics Commission of the International Union of Soil Sciences

The Richard Webster medal was established before the last World Congress of the International Union of Soil Sciences (IUSS). The award is for the best body of work that has advanced pedometrics (the subject) in the period between the IUSS World Congress of 2006 and the next one in 2010. However, achievements before that period will also form part of the evaluation (see more detail below). The award will be made at the next meeting of the IUSS World Congress. The first award was made to Professor Alex McBratney (University of Sydney) at the World Congress in Philadelphia (USA).

Guidelines for the award of the Richard Webster Medal

The official rules are also at http://www.iuss.org/popup/Webster_medal.htm

Requirements and eligibility for the award of the Richard Webster Medal

1. Soil scientists eligible for the award will have shown:

   a) a distinction in the application of mathematics or statistics in soil science through their published works,

   b) innovative research in the field of pedometrics,

   c) leadership qualities in pedometrics research, for example, by leading a strong research team,

   d) contributions to various aspects of education in pedometrics (e.g. supervision of doctoral students, teaching of pedometrics courses in higher education, the development of courses for broader professional needs),

   e) and service to pedometrics (e.g. by serving on a committee of the Pedometrics Commission or promoting pedometrics to the IUSS).

2) A nominee should be a member of the IUSS at the time of the nomination and have been involved in activities associated with pedometrics, in particular.

3) The nominee must be living at the time of the selection; retired pedometricians still active in pedometrics research will be eligible for the award. The nominee should be willing to receive the medal at the time and place designated by the IUSS World Congress, and be a keynote speaker at the next conference of the Pedometrics Commission (held biannually) following the presentation of the medal.

4) The Pedometrics Commission will pay for the recipient's travel expenses to attend the Pedometrics meeting where the keynote address will be given.

5) Members of the Awards and Prizes Committee shall be ineligible to receive the medal while serving on the Committee.

6) The award of the Richard Webster Medal shall not be presented to any one individual more than once.

Nominations procedure

1) Nominations for the Richard Webster Medal should be made by a colleague or colleagues who know the person's work well. The nomination should include a résumé and a short statement (a maximum of 750 words) summarizing the relevant qualifications of the nominee with respect to the conditions outlined in the section, requirements and eligibility, above.

2) The proposer(s) should submit the following on behalf of their nominee two months before the next IUSS conference (August 2010), i.e. before the 1st of June 2010:

   a) their published work for the four-year period between consecutive IUSS meetings,

   b) a suitable curriculum vitae that gives:

   - all previous publications,
   - positions held,
   - research undertaken,
   - education of others,
   - teaching courses developed,
   - and leadership and management of research projects.

This material should be sent to the Pedometrics Awards Committee chair, Professor Margaret Oliver at m.a.oliver@reading.ac.uk.

Inclusion of any of the above must show clear relevance to pedometrics.

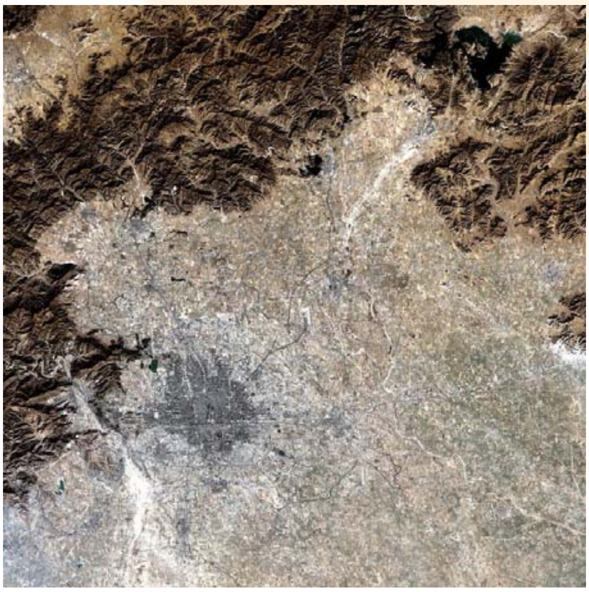
An Introduction to Beijing

General Information of Beijing

Beijing (also called Peking) is the political, educational, and cultural center of the People's Republic of China (PRC). As China's second largest city, the municipality of Beijing has a population over 17 million. Beijing is one of the Four Great Ancient Capitals of China.The city hosted the 2008 Olympic Games.

There are 18 districts and counties in the municipality: the eight districts of Xicheng, Dongcheng, Xuanwu, and Chongwen in the central city form the metropolitan area; the districts of Shijingshan, Haidian, Chaoyang, and Fengtai locate in the inner suburbs; and the districts of Fangshan, Mentougou, Changping, Shunyi, Tongxian, and Daxing as well as the counties of Yanqing, Huairou, Miyun, and Pinggu locate in the outer suburbs.

The urban area of Beijing is situated in the south-central part of the municipality and occupies a small but expanding area. It spreads out in bands of concentric ring roads (the numbering starts at 2), of which the fifth and the Sixth Ring pass through several satellite towns. Tian'anmen (Gate of Heavenly Peace) and Tian'anmen Square are at the centre of Beijing, and are directly to the south of the Forbidden City, former residence of the emperors of China. To the west of Tian'anmen is Zhongnanhai, residence of the top leaders of the PRC. Running through central Beijing from east to west is the Chang'an Avenue, one of Beijing's main thoroughfares.



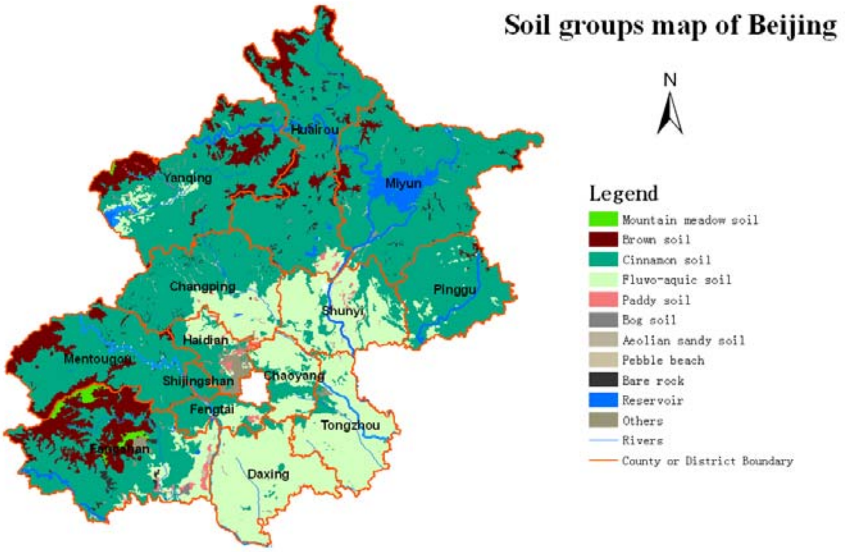
Satellite image of Beijing Municipality, showing the city of Beijing (in dark gray) with mountains in the north and west and plains to the east and south

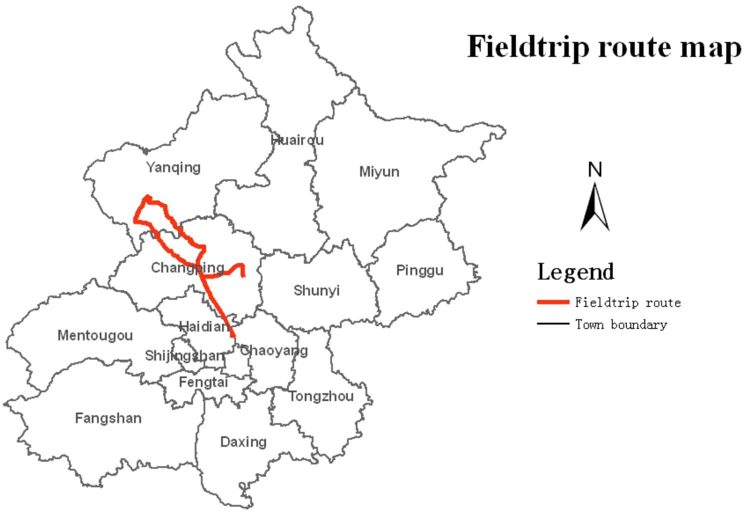
Few cities in the world besides Beijing have served as the political and cultural centre of an area as immense as China for so long. Beijing is renowned for its opulent palaces, temples, and huge stone walls and gates. Its art treasures and universities have long made the city a centre of culture and art in China.

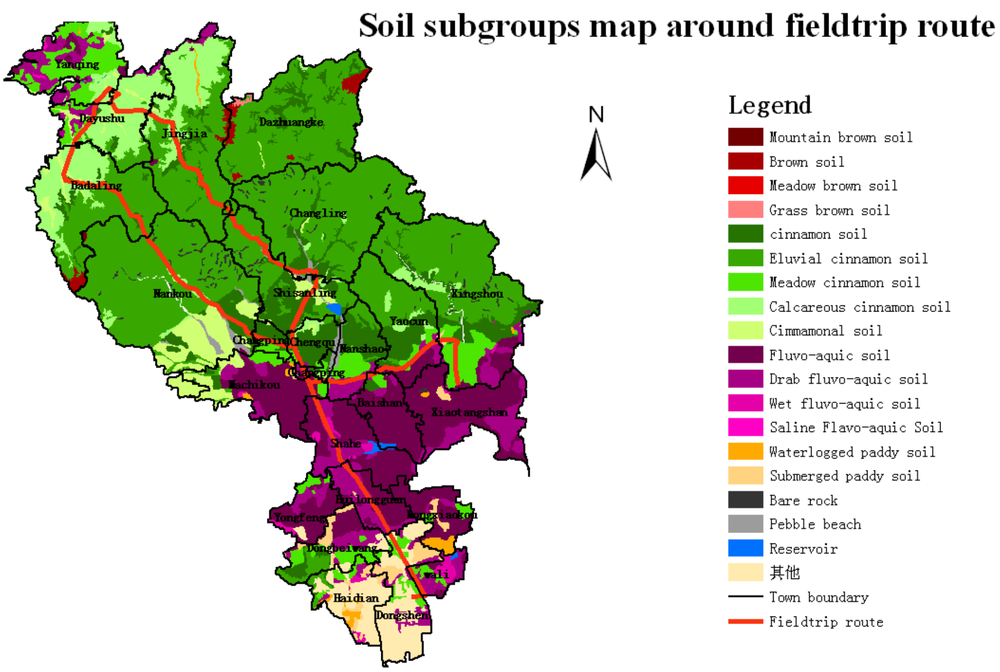
Geography of Beijing

With coordinates of 39° 54' 50 N and 116° 23' 30" E, Beijing shares roughly the same latitude as Denver (39° 44' N), Indianapolis (39° 46' N), Columbus (Ohio) (39° 59' N), Philadelphia (39° 57' N), Ankara (39° 52' N), and Bukhara (39° 46' N). The city lines up at about the same longitude as Xilinhot, Inner Mongolia Autonomous Region (116° 1' E); Kota Kinabalu (116° 5 E); and Mataram (116° 7' E).

Beijing is situated at the northern tip of the roughly triangular North China Plain, which opens to the south and east of the city. Mountains to the north, northwest and west shield the city and northern China's agricultural heartland from the encroaching desert steppes. The northwestern part of the municipality, especially Yanqing County and Huairou District, are dominated by the Jundu Mountains, while the western part of the municipality is framed by the Xishan Mountains. The Great Wall of China, which stretches across the northern part of Beijing Municipality, made use of this rugged topography to defend against nomadic incursions from the steppes. Mount Dongling in the Xishan ranges and on the border with Hebei is the municipality's highest point, with an altitude of 2303 m. Major rivers flowing through the municipality include the Yongding River and the Chaobai River, part of the Hai River system, and flow in a southerly direction. Beijing is also the northern terminus of the Grand Canal of China which was built across the North China Plain to Hangzhou. Miyun Reservoir, built on the upper reaches of the Chaobai River, is Beijing's largest







reservoir, and crucial to its water supply.

Beijing has a monsoon-influenced humid continental climate (Koppen climate classification Dwa), characterized by hot, humid summers due to the East Asian monsoon, and generally cold, windy, dry winters that reflect the influence of the vast Siberian anticyclone. Average daytime high temperatures in January are at around 1 °C (33°F), while average temperatures in July are around 30°C (87 °F). The highest temperature ever recorded was 42 °C (108°F) and the lowest recorded was -27°C (-16°F). In 2005, the total precipitation was 410.77 mm and the majority of it occurred in the summer.

Soils and Landscapes around Beijing

There are seven soil groups in Beijing: Mountain meadow soil, Brown soil, cinnamon soil, Fluvo-aquic soil, Bog soil, Paddy soil, and Aeolian sandy soil. The dominant soil types are cinnamon soil, Fluvo-aquic soil, and Brown soil, with an area of 890,500 ha (64.9%), 338,400 ha (24.7%), and 130,300 ha (9.5%) respectively.

The distribution of soil types in Beijing exhibits a regular trend with elevation. With decreasing elevation, soil types are found in the following order: mountain meadow soil, brown soil, cinnamon soil, and fluvo-aquic soil. Mountain meadow soils are mainly distributed in the southwest of Beijing at elevations higher than 1800 m. Brown soils mainly occur in the mountainous region at elevations higher than 800m. The cinnamon soil occupies the largest area, distributed widely on low hills and piedmont plains in southwest and northern parts of Beijing. Fluvo-aquic soil is mainly distributed at alluvial flats in the southeast and east of Beijing.

The soil subgroups along the fieldtrip route include Mountain brown soil, Brown soil, Meadow brown soil, Grass brown soil, cinnamon soil, Eluvial cinnamon soil, Meadow cinnamon soil, Calcareous cinnamon soil, Cimmamonal soil, Fluvo-aquic soil, Drab fluvo-aquic soil, Wet fluvo-aquic soil, Saline Flavo-aquic Soil, Waterlogged paddy soil, Submerged paddy soil, and Aeolian sandy soil.

An Introduction to China Agricultural University

An Introduction to the China Agricultural University and the Department of Soil and Water Sciences

Gymnasium of the China Agricultural University

The China Agricultural University (CAU), specializing in agriculture, biology, agricultural engineering, veterinary medicine, economics, rural management, humanities and social science, is the top university in agricultural study and education in China. At present CAU has 13 colleges with more than 1500 faculty members, 14,000 undergraduate, and 3,000 graduate students. The CAU gymnasium hosted the wrestling events for the 2008 Summer Olympics.

As the origin of higher agricultural education in China, the history of CAU could be traced back to 1905 when the College of Agriculture was founded in the Jing Shi Da Xue Tang. In September 1949, the Beijing Agricultural University (BAU) was established by merging the College of Agriculture of three universities: Peking University, Tsinghua University, and North China University. In October 1952, the Beijing Mechanized Agricultural College (renamed as Beijing Agricultural Mechanization Institute, BAMI, in July 1953) was created on the basis of Department of Agricultural Machinery of BAU, North China College of Agricultural Machinery, and the Central Agricultural Mechanization School of Ministry of Agriculture. In 1985 the BAMI was renamed as Beijing Agricultural Engineering University (BAEU). In 1995 the BAU and the BAME was merged to form the CAU.

Soil science is one of the key disciplines in the China Agricultural University. The **Department of Soil and Water Sciences** (DSWS), with 27 faculty members, provides highly visible leadership in teaching, research, and outreach programs as related to understanding soil physical, chemical, and biological processes, to improving agricultural productivity with environmentally sound management practices, and to consecrating soil and water resources in China. The DSWS is one of the few in China that offers a comprehensive research and educational programs involving cropland, grassland, and forestry ecosystems of the landscape. As the growing concerns in food security and the soil and water systems become more fragile in China, the SDSWS designed their programs to meet the challenges at local, regional, and national levels. Currently, the SDSWS's teaching, research, and extension programs are focused on 1) quantification of soil and water processes, 2) precision water and nutrients management and modeling in soil-plant systems, 3) regional soil resource management, 4) virtual plant growth modeling, and 5) soil biology and biochemistry, with broader implications for soil and water quality, agricultural land productivity, and climate change.

Report from EGU Conference 2009
Digital Soil Mapping

Florence Carre

The EGU Conference took place in Vienna from the 20th to the 25th of April 2009. The DSM Session was one of the most attractive one since it lasted one day (Monday 20th of April)-usually the sessions are lasting 3 hours- and gathered about 50 participants. 24 oral presentations were given and 21 posters presented.

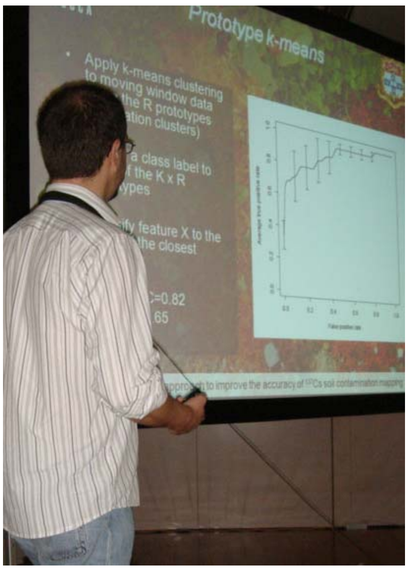
Most of the presentations (22) were dealing with use of sensors, building new sensors and integrating sensors for digital soil mapping. This thematic is the object of two different projects funded by the European Commission, called I-SOIL (http://www.isoil.info/) and DIGISOIL (http://eusoils.jrc.ec.europa.eu/projects/DIGISOIL/). It was then an opportunity for the project partners to meet and exchange on the subject.

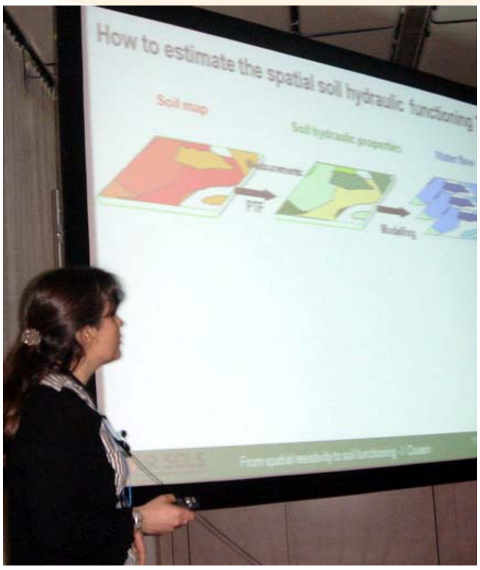
In the sensor session, most of the sensors used generally were dealing with apparent electrical resistivity. Two new sensors were introduced: seismic surface waves (Samyn et al.) and a new electromagnetic induction (André et al.). Lambot et al. showed also advanced ground-penetrating radar. Although the technologies seem heavy to implement, the results are promising for predicting soil features and properties. Nüsch et al. presented results of experiments where different Electro-Magnetic Induction sensors were tested and showed same spatial variation of the signals but with different absolute responses. This leads to take care of the sensors for inter-comparison exercises. Hyperspectral was used by Jaber and Land, Moretti et al. and Stevens and van Wesemael. Usually the results showed that hyperspectral can predict well organic carbon content.

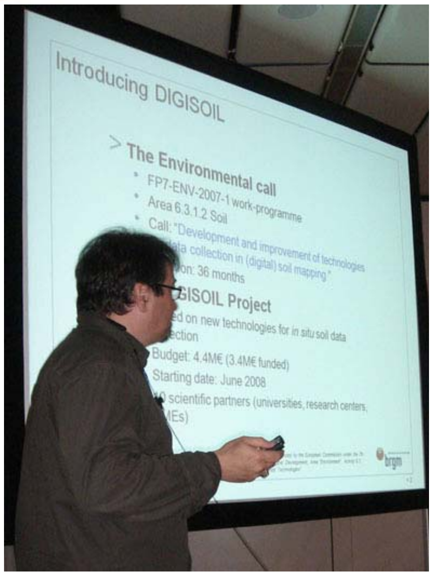
Digital Soil Mapping sensu stricto was the object of 10 different presentations. Baume et al. worked on the integration of different datasets coming from different networks and on soil input data harmonization using geostatistical techniques. Langella et al. presented different techniques for modelling and predicting clay content. Reuter et al. worked at continental scale and used regression-kriging for predicting soil pH. All the different techniques presented showed that geostatistics are efficient for interpolating soil properties at different scales. Behrens et al. presented ConMap, a software which is optimizing the neighbouring size of digital elevation attributes for modelling soil properties.

Digital Soil Assessment was represented 12 times. Carré et al. presented a spatio-temporal modeling of agricultural land prices and looked at the quantitative discrimination of soil attributes for explaining land prices. C. Ballabio et al. looked at plant association for improving the spatial modeling of ^{137}Cs soil contamination. Rainfall erosivity in Africa was modeled by Vrieling et al. using time series TRMM satellite images. Desprats et al., Seeling et al., Torres-Vera, Londhe et al., and Melendez-Pastor used satellite images for detecting and modelling erosion features, whereas Muller et al. used statistical approaches.

The next EGU Conference will be held again in Vienna. We hope to see you there next time, but also to the following DSM conferences: the 4th Global DSM Workshop, Roma, Italy, 24-26 May 2010, The DSM Session of the World Congress of Soil Science, Brisbane, Australia, 1-6 August 2010.







Report from EGU Conference 2009
Complexity & Nonlinearity in Soils

A.M. Tarquis, R.M. Lark & E. Perrier

This was the first session co-organized by the Nonlinear Processes in Geophysics and Soil System Science Groups at the EGU (European Geosciences Union). The purpose of this session was to discuss cross-disciplinary modelling and quantification of the soil system. New developments in mathematics, statistics and physics are increasingly finding applications in soil science, and we therefore believed that it was appropriate to bring together several researchers who deal with the complexity of soils at a range of spatial scales.

Many colleagues from different counties in Europe and from further a field (Australia, Brazil, Canada, Israel, Mexico, United States) contributed to this session with studies ranging from the conceptual to the applied.

Two sessions were held with oral presentations chaired by Murray Lark and Edith Perrier. A total of twelve oral presentations covered statistical approaches to studying scaling behaviour (Monitoring the soil degradation by Metastatistical Analysis presented by K. Oleshko, Random spatial processes and geostatistical models for soil variables presented by R.M. Lark, Multifractal analysis of topography: a case study at the regional scale presented by E. Vidal Vázquez), nonlinear dynamical systems in network connectivity (Percolation theory and connectivity of multiscale porous media presented by E. Perrier and N.R.A. Bird) and hydrology (Coupling between hydrology in unsaturated porous media and geochemical models presented by R. Chassagne, Evolution of the spherical cavity radius generated around a subsurface emitter presented by M. Gil), fully formulated physical-biogeochemical models (Modelling fungal growth in heterogeneous soil: analyses of the effect of soil physical structure on fungal community dynamics presented by R. Falconer, Root growth and uptake dynamics under different drip-irrigation strategies presented by A. Furman, Bayesian calibration as a tool for initializing the carbon pools of dynamic soil models presented by J. Yeluripati), optimization based on mathematical decision theory (Mathematical model to select the optimal alternative for an integral plan to fight against desertification and erosion presented by J.B. Grau), and complex network analysis (Porous Soil as Complex Network presented by R. M. Benito) Tom Addiscott, a senior fellow at Rothamsted Research gave an invited talk on Entropy, non-linearity and hierarchy in ecosystems, appropriate for the city where lie the remains of Ludwig Boltzmann.

The grave of Boltzmann in Vienna's Zentralfriedhof.

Maria Gil giving her presentation.

That evening we had an informal group dinner when Tom Addiscott was awarded with a T-shirt and a cup for his devotion, passion and friendship that has been showing during all this time. We are honoured that he came to our session and his talk was interesting and stimulating.

Next day A.M. Tarquis chaired a poster session, chair by, showed twenty one works dealing with several issues such as discrimination analysis (Discrimination of different sub-basins on Tajo River based on water influence factor presented by R. Bermudez), CT scan soil images related with soil structure (Pore network complexity and thresholding of 3D soil images presented by J.M. Anton) and hydraulic behaviour (Variation in spectral and mass dimension on 3D soil image processing presented by A.M. Tarquis, Soil hydraulic behaviour at different bulk densities presented by M. Ruiz-Ramos), several assessment on soil erosion (Analysis of shadows related to soil surface roughness as compared to the chain set method and direct measurement of micro relief and Shadow analysis: a method for measuring soil surface roughness presented by A. Paz González, Effect of tillage system and cumulative rainfall on multifractal parameters of soil surface microrelief presented by J.G.V. Miranda), multifractal and wavelets techniques on image analyses (Accuracy of Empirical Multifractal Analyses presented by N.R. Bird, Multifractal 3D spatial-scale analysis of soil variables using wavelets presented by D. Andina, Carbonate Reservoiring Capability Evaluation Based on Multifractal Analysis of Micropore Structures presented by S. Xie, Plant cannopy structure, turbulence and satellite soil classification presented by J.M. Redondo, Soil cover by natural trees in agroforestry systems presented by C. G. H. Diaz-Ambrona), hydraulic conductivity models (Fractal analysis of the hydraulic conductivity on a sandy porous media reproduced in a laboratory facility presented by S. De Bartolo, Percolation and solute diffusion in soil models; Laboratory and Numerical Experiments presented by D. Bolster, Assimilation of soil hydrophysic properties to a bundle of parallel capillaries presented by L. Juana, Multiscale characterization of pore size distributions using mercury porosimetry and nitrogen adsorption presented by J.G.V. Miranda, Predicting Soil Moisture in the Field from Amplitude Temperature presented by A. W. Al-Kayssi, Comparative assessment of five water infiltration models into the soil presented by M. Shahsavaramir), spatial variability in soil (Agent-based models to address the spatial complexity of biological and physical interactions in soils presented by G. Beurier, Assessment of soil nitrogen variability related to N doses applied through fertigation system presented by M.C. Cartagena) and analyzing organism movement through soil (Detrended-Fluctuation Analysis of Nematode Movement in Heterogeneous Environment presented by S.M. Hapca).

Ana Maria Tarquis and Tom Addiscott.

All these works can be found on the web page

http://meetingorganizer.copernicus.org/EGU2009/oral_programme/1292

Next year we are proposing to hold a a similar session. We hope to see you ….and your work!!!

Pedometrics Impression according to Google Image

The 4th Global Workshop on Digital Soil Mapping

From Digital Soil Mapping to Digital Soil Assessment: identifying key gaps from fields to continents

Rome, 24-26 May 2010

CNR Conference Room, Piazzale Aldo Moro, 7 - 00185 Roma

http://2010.digitalsoilmapping.org/

World Congress of Soil Science, Pedometrics Symposia

The Pedometrics Commission is sponsoring two symposia for the 2010 World Congress of Soil Science in Brisbane.

1.5.1 Quantitative monitoring of soil change (Convened by Murray Lark and Tom Bishop).

In this session we will consider the statistical problems of collecting spatio-temporal information on the soil. We will focus on the problems of designing appropriate monitoring and sampling schemes, on the use of information from novel sensing technologies, on statistical methods for spatio-temporal prediction and on integrating multiple sources of information on the soil. A keynote talk will be given by Dick Brus from Alterra, Wageningen.

1.5.2 Modelling critical processes in changing soil (Convened by Andy Whitmore and Matthew Pringle).

In this session we will consider some generic problems raised in quantitative modelling of processes in the soil. There are exciting new developments in the field of modelling which are all pertinent to the specific problems of soil modelling. In particular we will focus on data assimilation and Bayesian approaches to the estimation of model parameters and state variables, and for handling the uncertainty in our resulting estimates. We will consider the problems of predicting soil processes at appropriate spatial scales and of error propagation in process models. The outcomes of the error propagation analyses are essential to strike the right balance between model complexity and data availability. A keynote talk will be given by Gerard Heuvelink from Wageningen University.

1.3 Digital soil assessment (Convened by Florence Carré and Neil McKenzie).

This symposium focuses on Digital Soil Assessment which is the process beyond Digital Soil Mapping. Once the soil map and the associated accuracy have been produced, these serve as inputs for modelling soil processes (threats to soil, soil functions, soil-environment relationships). The accuracy produced during the DSM process should also be used in the soil-process modelling in order to obtain two kinds of outputs: the spatial distribution of the outputs of modelled soil process, and the associated accuracy of the prediction.

The Pedometrics and Paleopedology Commission will also hold a Divisional Symposium:

D1.2. Modelling the direction and rates of soil formation in time and space. Convenor – Edoardo Constantini and Budiman Minasny.

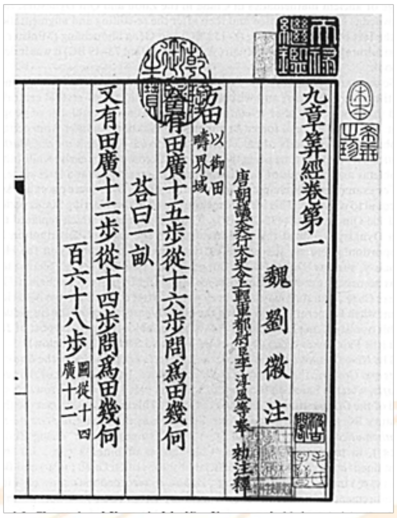
We encourage pedometricians to submit abstracts to these symposia, and to join us at WCSS 2010 in Brisbane. Abstracts must be submitted by 31st October 2009. For submission, and more details visit http://www.ccm.com.au/soil/index.html

The Nine Chapters on the Mathematical Art

九章算術

Murray

The *Nine Chapters on the Mathematical Art* (*Jiŭzhāng Suànshù*, 九章算術) is a compendium of Chinese mathematics developed from the 10th to the 2nd centuries before the common era, and appearing in a single written form in 179 CE. Mathematical development in China up to around this time had occurred independently of mathematics in the Greek world, and had a distinctive form: practical problems of taxation, trade, land management etc were stated and the most general solution was found and presented. This approach is illustrated by the *Suàn shù shū* (*Writings on Reckoning*) of the 2nd century BCE of which an English translation and fascinating commentary is available on the web at http://www.nri.org.uk/SuanshushuC.Cullen2004.pdf



九章算經卷第一

魏 劉徽 注

唐朝議大夫行太史令上輕車都尉臣李淳風等奉勅注釋

方田 以御田疇界域

今有田廣十五步從十六步問為田幾何

荅曰一畝

又有田廣十二步從十四步問為田幾何

荅曰一百六十八步

Perhaps pedometricians might find this traditional Chinese approach more congenial than the Greek tradition of the west in which most of them were educated. The Nine Chapters includes independent developments of mathematics with which pedometricians will be familiar, including Pythagoras's theorem (see below) and the method of Gaussian elimination for solving linear equations that appeared in the West in the 18th Century.

So here is an opportunity to get to grips with a problem from the *Nine Chapters*. First, some units of measurement. 1 *cùn* (approximately an inch) is the tenth part of a *chí* . You should be able to make sense of the following translation, taken from Cullen (2004) (link above).

今有圓材徑二尺五寸欲為方版令厚七寸問廣幾何

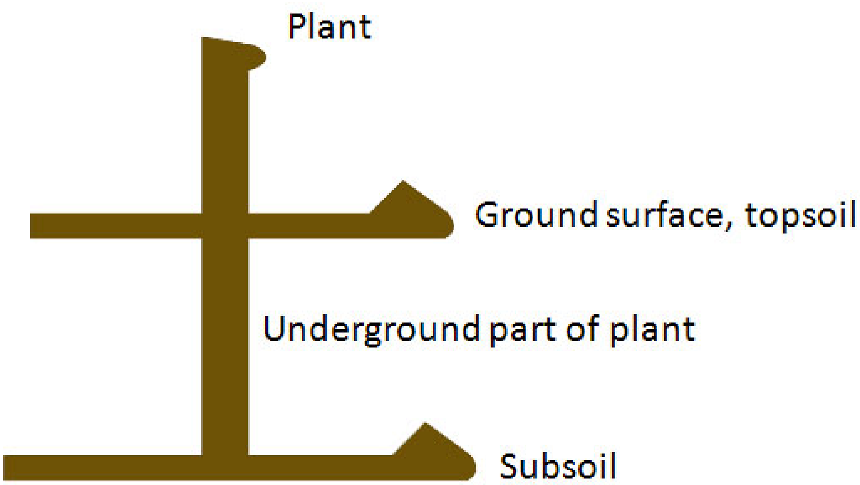
荅曰
二尺四寸

術曰
令徑二尺五寸自乘以七寸自乘減之其餘開方除之即廣

Now there is a round timber of diameter 2 *chí* 5 *cùn*; it is desired to make a rectangular plank, making the thickness 7 *cùn*. Question: how much is the breadth?

Answer: 2 *chí* 4 *cùn*.

Method: let the diameter 2 *chí* 5 *cùn* multiply itself; reduce it by the 7 *cùn* multiplied by itself; as for the remainder, reduce it by opening the square [i.e. find the square root], and that is the breadth.



The interpretation of the Chinese character for Soil.

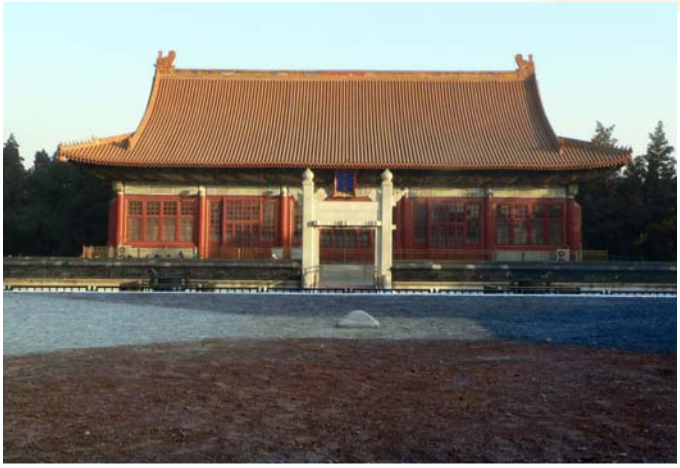
The Gods of Soil

Budi

The god of soil or earth has been worshipped in traditional Chinese religion since ancient times. Soil or earth is one of the 5 elements in traditional Chinese cosmology (the other elements are metal, wood, water, and fire). The god of soil is traditionally known as *She* 社, one of the most important deities associated with agriculture and fertility. In later times, the god of soil is worshipped together with the god of grain, *Ji*, together known as *She Ji* 社稷, a combined patron deity of soil and harvests. The god of soil, known by the name of *Ju Long* (a mythical figure), is said to be an expert pedologist who is able to determine the special properties of the soil of a region so as to decide what crops to grow there.

China's earliest legendary emperors are said to have worshiped *She*, for they alone had responsibility for the entire earth and country. Later Chinese emperors worshiped the gods of the soil as a more particularized cult than that offered to sovereign earth. Today, the Altar of Soil and Grain can be found in *Zhong Shan* (Sun Yat Sen) Park, southeast of the Forbidden City, Beijing. The altar, built in 1421, was used by the emperors of the Chinese dynasties for offering sacrifices to the gods of soil and grains. The altar is a square terrace of white marble with three tiers. The top tier is sectioned and filled with soil in five different colours (yellow in the centre, blue in the east, red in the south, white in the west, black in the north). This is reflecting the general distribution of soil in China: in the east of the country most soils are bluish in colour because of gleying; in the south the dominant soils are reddish Ferrosols; in the northwest Aridosols and saline soils often are whitish; and in the centre yellow soil is formed on the Loess Plateau.

There is also the Temple of Earth in Beijing *Di Tan* (地壇), which is located in the northern part of the city. It is the second largest of the four temples of Beijing, built in 1530, and located behind the Temple of Heaven. Because the Temple symbolizes the Earth, its footprint is square. The square is a powerful symbol in Chinese culture and mythology signifying Earth (There is a saying that "the Heaven is round, and Earth is square"). The Temple of Earth is located in the north of Beijing.



The Altar of Soil and Grain with five colour soils in Zhong Shan Park, Beijing (from Wikipedia).

The God of Soil, *Du Ti Gong*, a patron deity for soil scientists. (from Wikipedia)

A shrine for the God of Soil, Du Ti Gong. (from Wikipedia)

The god of soil was in charge for everything in the land, but later he evolved into a guardian deity of blessings in charge of the happiness and misfortune of the people in the locality. For common Chinese people, the god of soil, is more popularly known as *Tu Di Gong* (土地公) literally means Grandpa Soil. He is a popular deity worshipped by the Chinese folk religion. Although a deity, he is considered to have a lower position in the world of gods with limited power, but he is a kind & happy old man. *Tu Di Gong* is a humble, friendly guardian of nature, agriculture and land. He is still being worshiped today by the Chinese (in mainland and outside of China), mostly as small shrines, commonly located on the ground. He is a benevolent administrator and integrator for families or communities. The birthday of the god of soil is the 2nd day of the 2nd lunar month in Chinese calendar. Every year on the mid-autumns festival, he will also inspect the fields, blessing farmers with favourable weather in the next year. Next time if you see a shrine on the ground, pay homage to the god of soil. And when you are in Beijing, don't forget to visit the altar of five coloured soils.

References

Gong, Z., Zhang, X., Chen, J., Zhang, G., 2003. Origin and development of soil science in ancient China. Geoderma 115, 3-13.

Lu, Y.K., 2001. 100 Chinese Gods. Asiapac.

Winiwarter, V., Blum, W.E.H. Souls and Soils: A survey of worldviews. In: Footprints in the Soil. (B.P. Warkentin Ed), Elsevier, pp.107-122.

Wong, D.C., 2004. Chinese Steles: Pre-Buddhist and Buddhist Use of a Symbolic Form. University of Hawaii Press.

http://en.wikipedia.org/wiki/Temple_of_Earth

http://en.wikipedia.org/wiki/Tu_Di_Gong

http://en.wikipedia.org/wiki/Zhongshan_Park_(Beijing)

Did you miss this? …

Murray

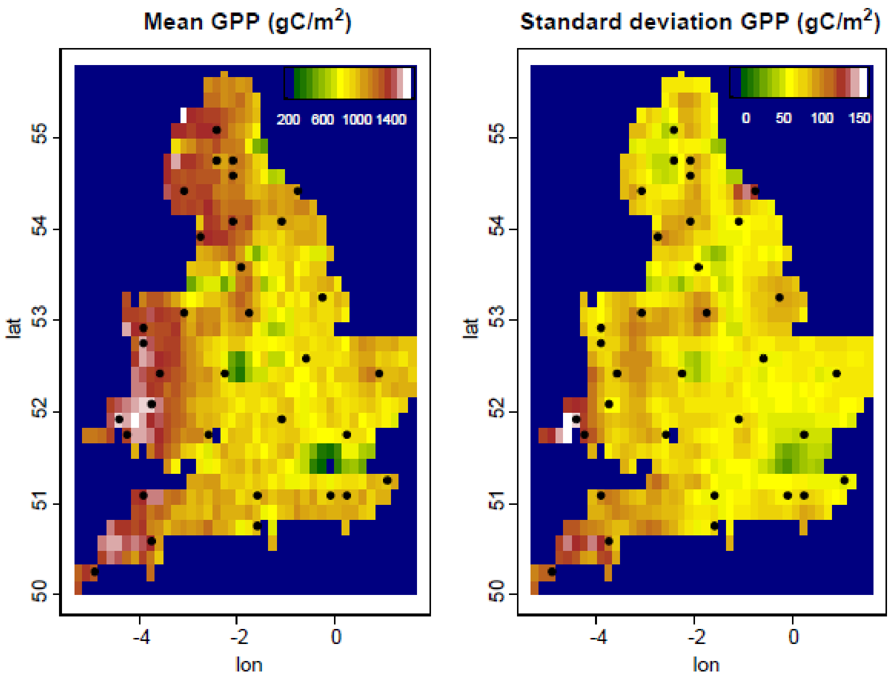
Kennedy, M., Anderson, C., O'Hagan, A., Lomas, M., Woodward, I and Gosling, J.P. 2008. Quantifying uncertainty in the biospheric carbon flux for England and Wales. Journal of the Royal Statistical Society (A) 171, 109-135.

This paper is by a multidisciplinary team from the University of Sheffield in England. Its objective is to use process models to predict the 'net biome productivity' (NBP), the net uptake of atmospheric carbon by vegetation and soil, for principal vegetation classes in England and Wales, and so to derive an estimate of whether soil and vegetation together are a net source or sink of carbon.

There is no space to give a comprehensive account of the paper, but it does contain items that will interest pedometricians. The first is the use of emulators. Process models are often complex. If we want to account for the uncertainty in their parameters and inputs when assessing their predictions, then we will often need to generate multiple sets of outputs. This can become computationally costly. Emulators are linear Gaussian models which approximate the outputs of the model given the inputs, and so can be used for a more rapid analysis of the uncertainty in the former arising from uncertainty in the latter. Emulators are particularly important for computationally intensive approaches such as modern Bayesian methods.

The approach that the authors take to uncertainty is interesting. To predict the carbon budget for a grid cell requires runs of the model for the different constituent vegetation types. The errors in these predictions will be correlated (the different model runs will have common inputs), and this must be accounted for when the predictions are combined into a single budget for the cell. Similarly, the correlations between cells must be accounted for when their outputs are aggregated into national or regional budgets. An interesting account is given of how the model emulators make this feasible.

Finally, the authors use uncertain soil data. Pedometricians would want to see rather more information here, and might be concerned with the paper's ad hoc approach to some problems. It seems curious, for example, to handle the effects of non-linearity on upscaled estimates from support of a few metres to a large grid cell by an arbitrary inflation of the prediction variance. We might also wonder about the reliability of kriged corrections based on just 33 observation sites across the country. Nonetheless, this paper is well-worth a read, since it sets out explicitly to quantify the error budgets of predictions of important biogeochemical variables.



Pedometrics Family Tree

Tom Bishop

In 2004 I began a postdoctoral position with Murray Lark in the United Kingdom and some time it came up in conversation that he was the last PhD student of Phillip Beckett at Oxford and that Richard Webster was the first of Beckett's students to research what we now call Pedometrics. This had me thinking, Richard was the PhD supervisor of my PhD supervisor, Alex McBratney so I had gone to work for my Pedometric Grand Uncle Murray Lark and Murray was Alex's Uncle. Obviously Phillip had a long career producing Pedometric children.

Some time later I came across the Mathematics Genealogy project which traces the descendants of mathematicians through their PhD supervisor. What I present here is a first draft of the Pedometrics Family Tree, at least my part of it. While Alex came up with the term Pedometrics it seems that there is a strong case for calling Phillip Beckett one of, or the founding father of Pedometrics. Each colour represents a different generation of Pedometricians. Sam Buchanan is the only member of the latest generation in the tree but in the coming months he will be joined by Grant Tranter and Nathan Odgers, backcross products of co-supervision between Father and Son, Alex and Budiman. How will they turn out? Time will tell but the first results are promising!

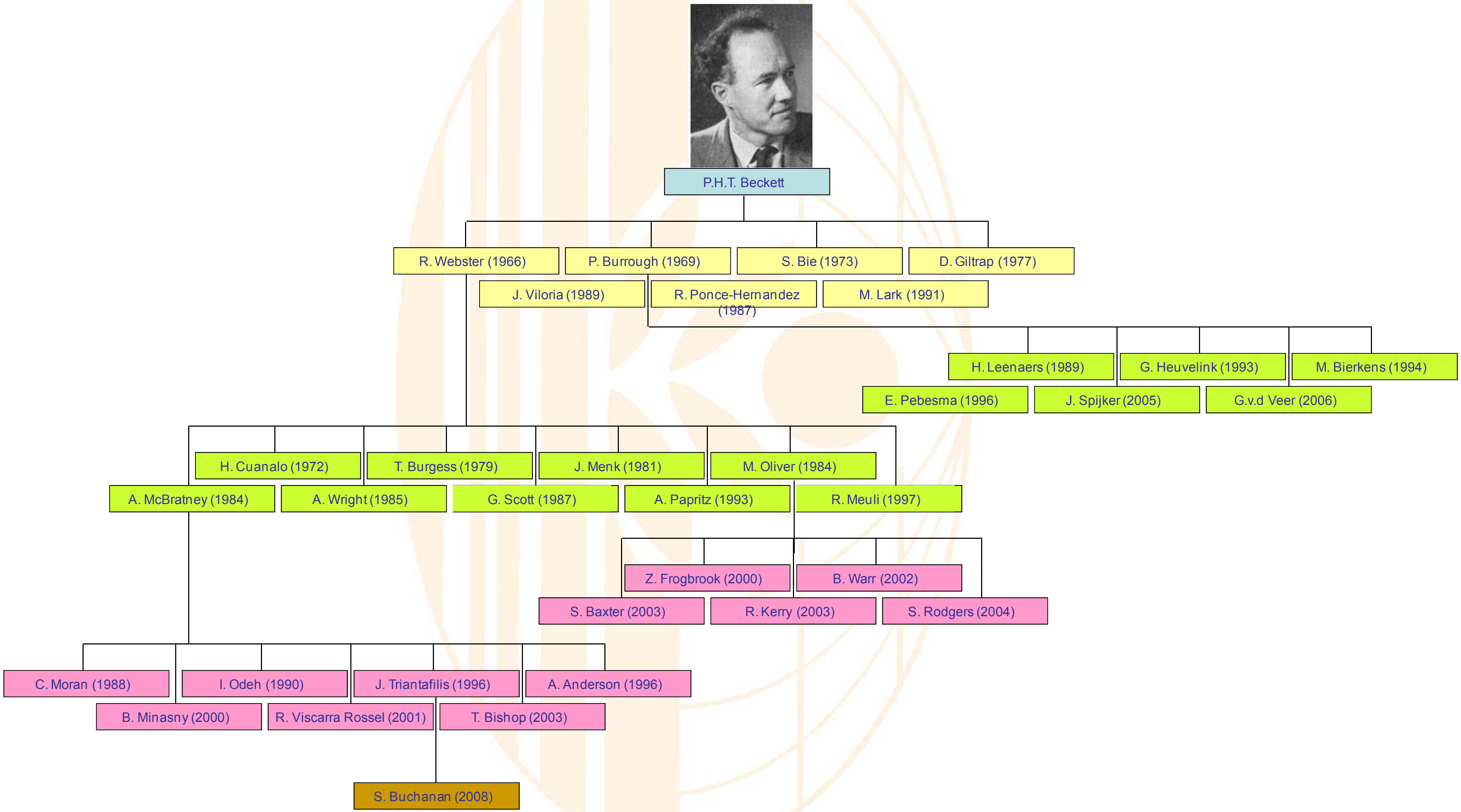
Obviously there are healthy trees developing concurrently to this one and I have made an attempt to contact other key Pedometricians to see how these trees have developed. However, Pedometron deadlines, European summer holidays and space have conspired against me. This may have been fortuitous as it has let me avoid delving deeper into the Dutch system of Promotors and Day Supervisors and trying to determine who the real parent or parents are. A website contains draft versions of some of these trees, thanks to Jaap and Marc.

Anyway any comments would be appreciated, especially about Peter Burrough's branch which is incomplete and based solely on article by van der Perk et al. (2007).

Reference

van der Perk, M., S. M. de Jong, R. A. McDonnell. (2007). "Advances in the spatio-temporal modelling of environment and landscapes (in honour of Professor Peter A. Burrough)." International Journal of Geographical Information Science 21(5): 477 - 481.

Pedometrics Family Tree



The Agua Salud Project

Investigating the effect of tropical reforestation on ecosystem services

Beate Zimmermann

Ecosystem services in the Panama Canal Watershed

The Panama Canal is the most important commercial waterway in the world. It relies on water – for approximately every tonne of cargo traversing the Isthmus, ten tonnes of water are released to the ocean. The water flowing through the Canal originates far up stream in the forested hills of the Panama Canal Watershed.

In the Canal Basin, the official policy is to reforest in the hopes of regaining ecosystem services. Its forests harbours tremendous biodiversity and represent vast reservoirs of carbon. They now attract thousands of tourists per year. Moreover, the Panama Canal Watershed is home to well over a hundred thousand people, including rural farmers. Land-use decisions can affect all the various users of the region. Choices of cover have collateral impacts – positive, negative, or unquantifiable. Positive impacts are often referred to as "ecosystem services" – included are carbon storage, water quantity and quality, biodiversity, environmental resilience, undiscovered pharmaceuticals. Some impacts, however, may be negative (costs) – elevated water loss through excess runoff or evapotranspiration, soil erosion, landslides, and extinction.

As land use decisions affect costs and benefits differently there are inherent tradeoffs between them. For example, while forests are clearly important for biodiversity conservation and carbon sequestration, they typically lose roughly 300 mm per year through evapotranspiration. In areas where water is a precious commodity, this dichotomy can lead to difficult policy decisions. In regions with seasonal drought, such as the Isthmus of Panama, dry-season stream flow is far more valuable than wet-season flow. Although reforestation is capable of reducing the enhanced peak flows and stormflows associated with post-clearing soil degradation, it remains unclear if this also produces a corresponding increase in low flows (Bruijnzeel, 2004). It has been hypothesized that the remediation of dry season flows after reforestation depends on the balance between an improved infiltration allowing groundwater recharge and the increased water use of trees and higher interception loss under forest canopies (Bruijnzeel, 1989).

The Agua Salud Project

The Agua Salud Project aims at quantifying the effect of reforestation and natural succession on ecosystem services, in particular on dry season flows, water quality, timber production, and carbon sequestration. The Agua Salud Watershed in Panama is the principal field site, which resembles a mosaic of old-growth forests, secondary forests of various ages, cattle pastures, small agricultural fields, and rural settlements. This variety of land uses is typical for rural Panama. Experiments at the scale of entire catchments permit complete water and carbon inventories and exchanges for different landscape uses.

Figure 1. Secondary succession catchment (left), native timber species reforestation (middle) and teak reforestation (right) in 2009.

In 2008, three small catchments in the Agua Salud Watershed, which by then had been used as cattle pastures, were reforested. One of these catchments was planted to teak (Tectona grandis) and another one to a native timber species plantation; the third one is left to natural succession (Figure 1). A pristine forest catchment and one which is entirely under active pasture serve as controls.

Being the target parameters of overriding importance, rainfall and runoff are continuously recorded in all watersheds. Soil nutrients, carbon sequestration in the soils and the above-ground biomass, interception loss, water quality, and several forest-stand parameters are also monitored. In order to test the hypothesis of a remediation of soil hydrological functions under a (new) forest cover, we annually measure the soil saturated hydraulic conductivity (hereafter K_s) in the reforestation catchments. In the following, I will focus on K_s and report on the preliminary survey, the baseline survey, and the challenges of data collection in rural tropical environments.

Monitoring the soil saturated hydraulic conductivity after reforestation: From the preliminary survey to the final sampling design

In February and March 2008 – the dry season – we conducted a preliminary survey in the forest and the pasture watershed as well as in two of the three catchments dedicated to reforestation. At that time, cattle had already been removed from the latter catchments, which were covered by pasture or young secondary vegetation (Figure 2).

The preliminary study aimed at adapting the monitoring sampling designs to the scales where most variability occurs. For each of the investigated catchments, we used an unbalanced nested sampling with 24 main stations located on a 100-m grid and three substation levels (10 m, 1 m, 0.25 m). At every sampling location, we also explored some soil and landscape attributes, e.g. surrounding vegetation cover and field texture. The measurements were done in situ with a compact, constant-head permeameter (Amoozemeter) at two topsoil depths. The results stressed the substantial small-scale variation of K_s as between one third and three quarter of the overall variation occurred already at the smallest separation distance. Nevertheless, the variance portion of up to 35% associated with measurements that are a 100 m apart indicated some larger-scale variation, too. Most soil and landscape attributes did not correlate with K_s except for vegetation parameters in one of the catchments. In terms of the subsequent monitoring, the preliminary study showed the importance of choosing an extent large enough to cover all existent variation and the inability to stratify the catchments by some auxiliary variable. Moreover, we noticed the widespread occurrence of soil cracks, which close some time after the onset of the rainy season. These cracks cast the validity of our field K_s values into doubt, whose calculation is subject to assumptions such as laminar flow; in addition, some long-term measurements of K_s indicated an effect of measurement time. These concerns prompted us to shift the monitoring time to the rainy season, when the soil cracks are typically closed. This posed a new problem, however, because our field measurements involve augering a borehole, in which the constant head is established. The soils in our research area vary between clay loam and clay, and they are more or less permanently wet during the rainy season; hence, smearing of the borehole appeared unavoidable. Therefore, the shift in monitoring time had to be accompanied by a shift in methodology; that is, from field measurements to the collection of undisturbed soil cores which are transported to a lab and measured using the constant-head method.

Figure 2. A typical pasture in the Agua Salud watershed.

Before we eventually started collecting the pre-reforestation data, which characterize the baseline condition for the intended monitoring, we had to develop the monitoring sampling schemes. Since we are interested in the change of the spatial mean over time, we decided for a design-based approach. Although our preliminary survey did not suggest stratification by an ancillary variable we chose a stratified simple random sampling with compact geographical stratification so as to avoid the possible clustering of sampling locations which may occur for a simple random sampling design.

Figure 3. A road in the project area during the rainy season.

It was a challenge to accomplish the baseline survey before the reforestation started, hoping for the partially arriving equipment and driving on muddy "roads" (Figure 3). Now, a year later, we are on the brink of the first post-reforestation campaign. In the meantime, some roads have been improved and most equipment has arrived. Needless to say, there are many years to come until we will be able to decide if reforestation indeed improves soil hydraulic functions, where it does, and how long it takes.

Acknowledgements

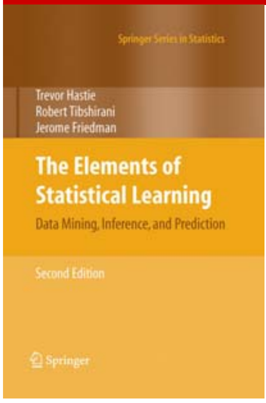
The Agua Salud Project is sponsored as part of The HSBC Climate Partnership, a partnership between HSBC and The Climate Group, Earthwatch Institute, Smithsonian Tropical Research Institute, and WWF.

When I just started to work in Panama, Andreas Papritz from the ETH Zuerich and Murray Lark from Rothamsted Research came to visit the experiment and helped with the sampling designs. I really enjoyed the time we spent together in the tropics, and we acknowledge their essential input. Just recently Dick Brus from Wageningen University joined the discussion and made some very useful suggestions about how to improve the sampling designs. The numerous data which were required in the first year had mainly been collected by a PhD student, Sibylle Hassler, and students of the University of Potsdam. I greatly acknowledge their commitment to work under rather unfavorable conditions, which include baking in the tropical sun, sliding down steep slopes and getting stuck on a road in the middle of nowhere.

References

L.A. Bruijnzeel. 1989. (De)forestation and dry season flow in the tropics: a closer look. Journal of Tropical Forest Science, 1, 229–243.

L.A. Bruijnzeel. 2004. Hydrological functions of tropical forests: not seeing the soil for the trees? Agriculture Ecosystems & Environment, 104, 185-228.



The Elements of Statistical Learning. 2nd Edition

Trevor Hastie, Robert Tibshirani, Jerome Friedman

Springer Series in Statistics, 2009. ISBN 0172-7397. 745pp.

This is the new edition of my favourite statistical modelling book. It explains most prediction models frequently used by pedometricians for prediction and classification. The techniques and topics covered in this book are now mostly used in digital soil mapping to predict continuous soil attributes or soil classes. "Data mining, Inference, and Prediction" is what this book is about.

The first thing you will notice is the nice colourful graphs, first impression lasts. The book covers a variety of topics from simple linear regression to modern data mining techniques. Everything you need to know about prediction and classification techniques is in this book. Each technique is described clearly and in a way that is simple to understand. For those who still think neural networks are mysterious blackboxes mimicking complex human brain, see pages 392–393 for explicit explanation of the formulae involved.

Chapter 2 gives an overview of supervised learning. Chapter 3 starts off with linear regression methods, includes stepwise regression, principal component regression, and PLS. Chapter 4, on linear methods for classification, includes linear discriminant analysis and logistic regression. Chapter 5 is mainly on splines, and a bit on wavelets. Chapter 6 is on kernel smoothing methods. Chapter 7 covers an important topic — model assessment and selection, including cross validation and bootstrap methods. Starting from Chapter 9, we are introduced to more sophisticated prediction methods, including GAM, Tree Models, and MARS. Chapter 11 is on neural nets and Chapter 12 on Support Vector Machines. Chapter 13 presents prototype methods and nearest neighbours. Chapters 10 and 16 discuss boosting and ensemble methods.

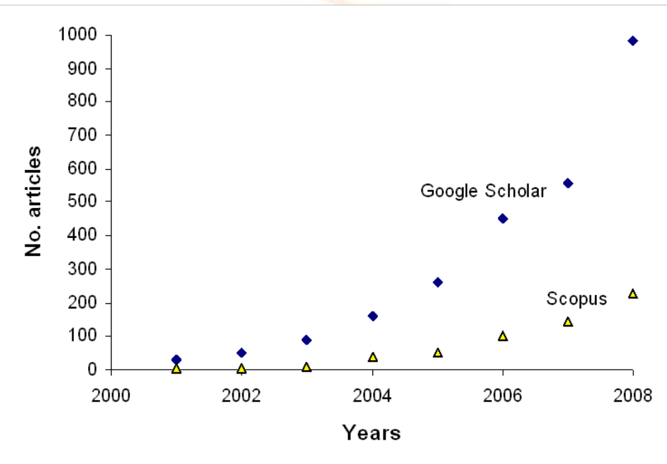


Figure 1. No. articles on "random forests" since 2001 from Google Scholar and Scopus.

Chapter 15 is new in this edition and describes the now frequently used Random Forests (see Fig. 1). It is available as a free Fortran and R codes. Leo Breiman (who sadly died in 2005) is mostly known for developing classification and regression trees (CART). CART is liked by pedometricians because it is easy to interpret. However, Breiman took it further by growing lots of trees in random forests. Random Forests have now become a kind of panacea for modellers as it is claimed that they have high accuracy, can handle lots of input variables, and cannot overfit the data (See our article in Pedometron no. 25). However, page 596 is an important read for those who used and intend to use random forests. The first is that when the number of variables is large but the fraction of relevant variables for prediction is small, random forests are likely to perform poorly with small *m* (variables randomly selected by the model). This is because at each split, the chance of selecting the relevant variable is small. The second is on the claim that random forests cannot overfit the data. The authors clearly state that this is not true, **random forests can overfit the data**, the average of fully grown trees can result in a model that is too rich and incurs unnecessary variance!

Chapter 14 is on unsupervised learning, now much used in soil data, including clustering. And finally Chapter 18 is on high dimensional problems, now much used for handling soil infrared spectra, including PLS, false discovery rate and many other new techniques!

Book Review

Although no soil data were used as examples, many of these techniques have been explored and trialled by pedometricians for digital soil mapping or making pedotransfer functions. This book does not deal with spatial variability and covariance functions. But there are still many techniques that potentially useful for soil data that haven't been explored yet, so read it carefully.

Chapter 7 on model assessment and selection is a must read for modellers, the issue of overfitting, selection parsimonious model, and overparametization are important and should be carefully scrutinised. The issue of overfitting is discussed in many chapters. Although the authors discuss the use of AIC and BIC for model selection, the effective number of parameters for the modern data mining techniques and ensemble models are not (yet) covered.

The layout of the book is excellent. The colourful graphs increase the readability despite the heavy formulae. Overall this is a great reference book for pedometricians! I frequently used the first edition of this book as a reference in many pedometrical problems (see e.g. Minasny and McBratney, 2007).

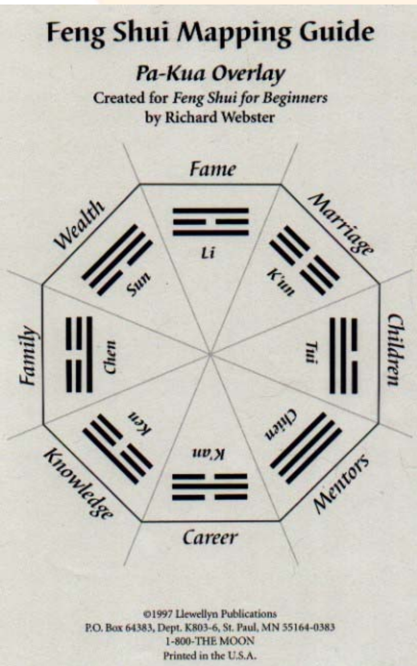
This book has a website that contains the data used in this book and also some R functions: http://www-stat.stanford.edu/~tibs/ElemStatLearn/

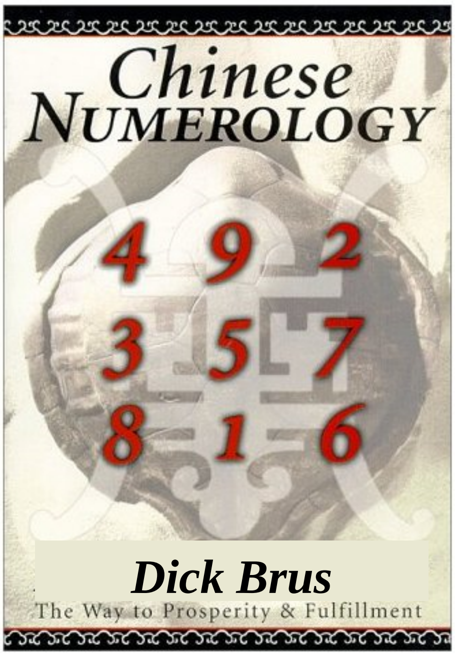
Reference

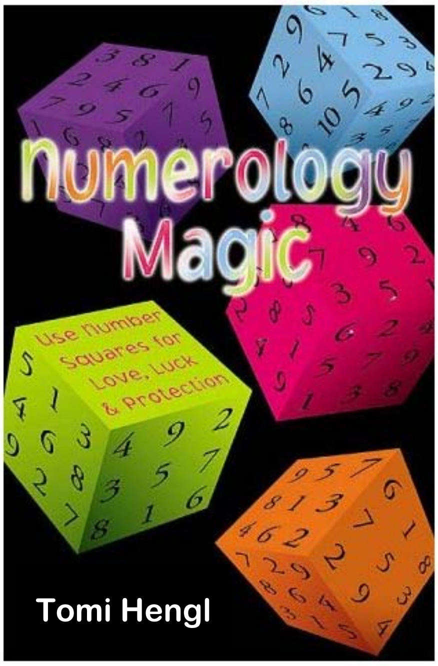
Minasny, B, McBratney, A.B., 2007. Incorporating taxonomic distance into spatial prediction and digital mapping of soil classes. Geoderma 142, 285-293.

Budiman Minasny
The University of Sydney
Australia

Alternative Books on Prediction & Inference







Soil Bibliometrics

More on Self Citations

Budiman Minasny, Alex McBratney & Alfred Hartemink

Some two years ago we wrote about self citations (Pedometron No. 22, pages 11-13). Self citation is indeed a favourable attribute and self-citations account for between 10% and 20% of all references, but it differs between disciplines. We analysed and manually counted papers from Pedometrics Special Issues which have been published in Geoderma. The minimum and maximum self citations that were found ranged between 0 and 60%, with a median of 15%. In general, Pedometrics papers have a self citation rate of around 15%. We had the impression that the self-citation rates differed considerable between countries. Here we we look at self citations by countries and also by journals. Self citation here can also mean that in your paper you cite papers from your own country or cite papers from the same journal.

Country Self citations

We used the data from SCImago for the period 1996-2007 in soil science. The SCImago Journal & Country Rank (www.scimagojr.com) is a portal that includes the journals and country scientific indicators developed from the information contained in the Scopus database from Elsevier. These indicators can be used to assess and analyse scientific domains.
Country self citation means the percentages of the citations received by the papers which come from the same country as from which the papers were published. Or you cite papers that come from your own countries. Figure 1 shows the number of papers produced and the percentage of self citations.

Countries with the highest no. of self citations are China and USA (63 and 48%, respectively). For the complete data see www.scimagojr.com

The trend seems to be that with every 10 fold increase in the number of papers, there is a 10% increase in self citations. So the more papers a country produce, the more likely it will refer to its own work. This is because the more papers a country produced, there will be more chance that a person from that country will cite more work from its own country. Countries with a large body of work are more inclined to cite papers from their own fellow countrymen and women. Smaller countries have fewer papers and hence cite more papers from other countries.

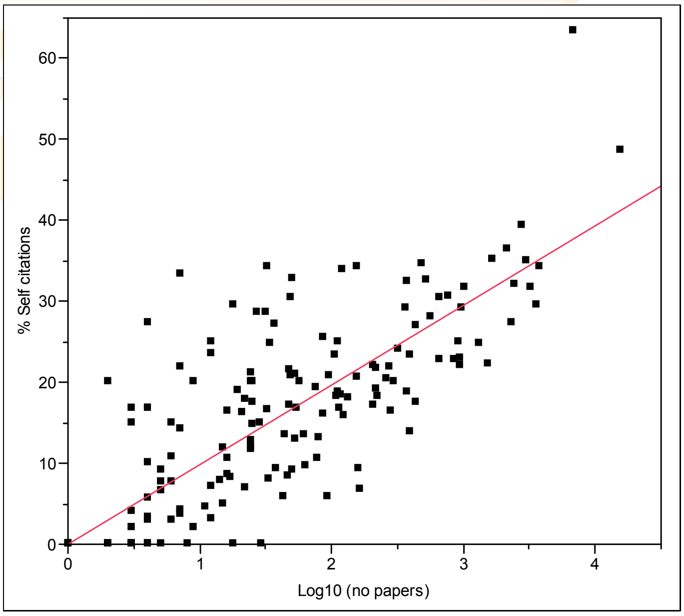


Figure 1. Log(number of papers) produced by various countries in the area of soil science 1996-2007 and its relationship with percent of self citations. % Self citations = 9.8 *Log_{10}(no papers). (data from SCImago)

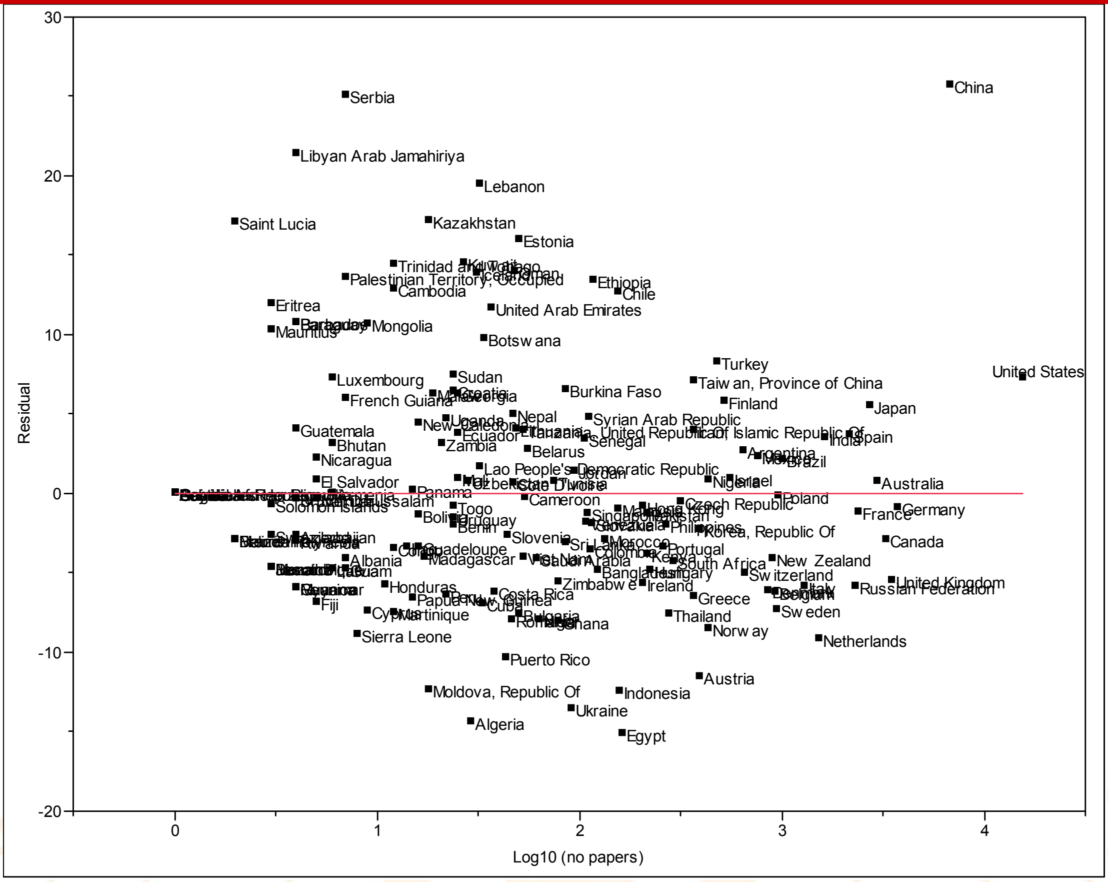


Figure 2. Residuals of the regression line from Figure 1.

If we takeout the trend, we can see the residuals of the regression (Figure 2). We can see which countries depart most from the trend or zero residuals. Some countries with high self esteem tend to over-cite themselves, but there are also countries who under-cite themselves. The US that seems to have a high country self citation rate according to the trend line should have a self citation rate of 41%. This is because US produces a lot of scientific work and it is normal that they will cite more work that come out from US. Meanwhile China , Serbia, Libya have high residuals, meaning that they tend to over cite themselves. Egypt, Algeria, Ukraine, Indonesia and other tend to under-cite themselves.

The trend line also gives you the likely country self citation rate for a paper. For example, a paper from Australia would have about 34% of self citations, the Netherlands: 31%, UK and Germany: 35%.

Journal Self citations

Journal self citations is an interesting subject as it can boost the impact factor! Impact factor is regarded as a measure of the quality of the journal and most scientists would like to publish in a high impact journal. But can the impact factor be manipulated with journal self citations? Journal self citation here means that you cite papers that are from the same journal.

Table 1 lists the impact factor of soil science journals from the 2008 Journal Citation Reports® from ISI. The distribution of self citations (Figure 3) is skewed by 3 outliers. The median percentage of self citations is 12%. So it seems that 12 % is about a normal self citation rate for a journal. As a comparison, the self citation rate in Nature and Science is 1%.

The impact factor can be manipulated by boosting journal self citations, for example the *Journal of Soils and Sediments* is ranked no. 2 simply because 42% of the citations are from the journal itself.

There is another metric called the Eigenfactor™ score that counters this problem. The Eigenfactor™ score ranks the influence of journals in the same way as

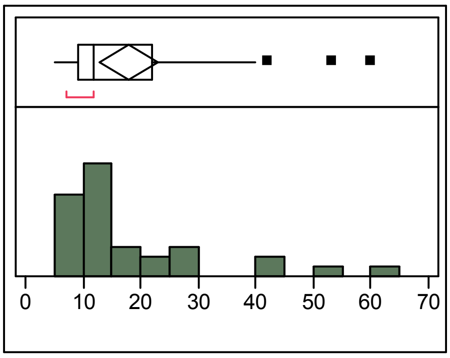


Figure 3. Distribution of percentage of self citations from soil science journals used in the impact factor calculation.

Table 1. Impact factor and Eigenfactor Score for the major Soil Science Journals in 2008 (from ISI)

Journal	Rank by Impact factor	Impact factor	Rank by Eigenfactor score	Eigenfactor score	% Self citations (used in Impact Factor Calculation)
Soil Biology and Biochemistry	1	2.926	1	0.03265	18
Journal of Soil and Sediment	2	2.797	25	0.00164	**42**
Applied Soil Ecology	3	2.247	8	0.00838	11
European Journal of Soil Science	4	2.24	6	0.01024	8
Soil Science Society of America Journal	5	2.207	3	0.02381	12
Geoderma	6	2.068	4	0.01978	15
Plant and Soil	7	1.998	2	0.02721	12
Soil Use and Management	8	1.895	17	0.00409	9
Catena	9	1.874	9	0.00773	10
Soil and Tillage Research	10	1.695	5	0.01136	10
Pedobiologia	11	1.451	16	0.0041	5
Biology and Fertility of Soils	12	1.446	10	0.00707	10
Vadose Zone Journal	13	1.441	7	0.0084	28
Journal of Plant Nutrition and Soil Science	14	1.284	12	0.00504	11
Nutrient Cycling in the Agroecosystems	15	1.282	11	0.00509	8
Land Degradation and Development	16	1.245	22	0.00239	16
Clays and Clay Minerals	17	1.171	15	0.00411	12
Soil Science and Plant Nutrition	18	1.152	20	0.00294	29
Journal of Soil and Water Conservation	19	1.121	19	0.0032	22
Soil Science	20	1.037	13	0.00456	7
Canadian Journal of Soil Science	21	1.023	21	0.00294	14
European Journal of Soil Biology	22	0.888	24	0.00189	12
Pedosphere	23	0.865	23	0.00203	8
Australian Journal of Soil Research	24	0.856	14	0.00438	20
Revista Brasileira de Ciencia do Solo	25	0.66	26	0.00119	60
Compost Science and Utilization	26	0.638	27	0.00115	25
Acta Agriculturae Scandinavica - Section B Soil and Plant Science	27	0.407	28	0.00067	8
Communications in Soil Science and Plant Analysis	28	0.357	18	0.00401	7
Arid Land Research and Management	29	0.348	29	0.00064	12
Agrochimica	30	0.179	31	0.00024	40
Eurasian Soil Science	31	0.149	30	0.00048	53

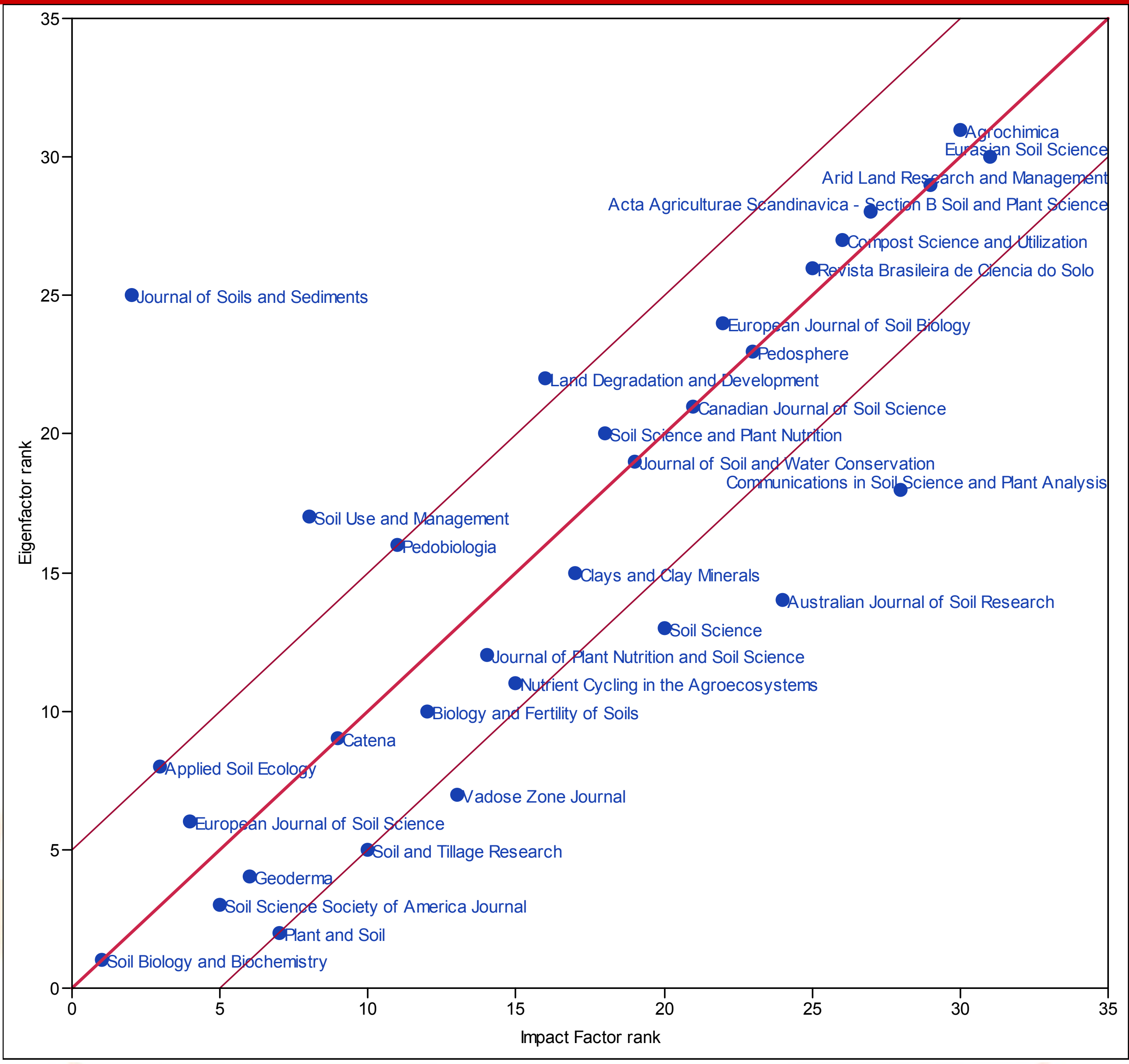


Figure 4. Soil Science journals' rank according to impact factor and Eigenfactor score. The thick line represents a 1:1 line, the outer lines represent a score different of 5 between the two rankings.

Google's PageRank algorithm ranks the influence of web pages. Journals are considered to be influential if they are cited often by other influential journals. See www.eigenfactor.org for more details. So the Journal of Soil and Sediment is ranked 25 based on Eigenfactor™ score.

If we plot the rank according to impact factor and eigenfactor score (Figure 4), we can see that most journals are close to the 1:1 line, except for Journal of Soil and Sediment. Soil Biology and Biochemistry ranks the first under both scores. There are journals which have a lower impact factor rank, but a higher eigenfactor rank. For example, Soil Science and Australian Journal of Soil Research have low impact factor rank, but in fact they were being cited by more influential journals. Meanwhile Soil Use and Management has a higher impact factor, but may not be cited by more influential journals. And Journal of Soils and Sediments is way outside the 1:1 line, indicating an extremely high self citation rate that favoured its impact factor.

In conclusion, self citation is contagious. Not only that you can boost your h index, but your country's pride and also your preferred journal's impact factor. (Note: If every time you published a paper, you cite every single paper that you have previously published, your h index will be at least the integer of ($n/2$), with n is the number of paper you have published).

Pedometrician profile

Zhou SHI

Zhejiang University, P R China

How did you first become interested in soil science?

Fifteen years ago, I got my bachelor degree in physical geography and became a graduate student in agricultural remote sensing. My thesis was about a soil data base on red soil in my home province. So in those years, I collected soil information through many field surveys and it was a hard task. As I remember, one time it coincided with paddy harvesting time, the train was so busy. I had to stand in the train for about six hours and arrived at a small town in midnight. As the saying goes, "No sweet without sweat". The hard field work also gave me a good opportunity to see many different beautiful landscapes from coastal land to paddy plain and to mountainous area in my home province. So I always think my first interest in soil science was attracted by the natural beauty indirectly.

How were you introduced to pedometrics?

In my graduate study, I was involved in soil mapping and application of GIS. In 2001, I travelled abroad for the first time to visit Queen's University Belfast (Northern Ireland). I worked with Dr. John Bailey on mapping soil variation in temperate grassland, and began to learn and use geostatistical methods and tools. Later, I grew into pedometrics. In 2006, I visited Rothamsted Research and met Professor Murray Lark. With the help of Murray Lark, we wrote a short review paper to introduce the origin and development of Pedometrics, which was published in the Journal of Soil Science Society of China. It is a first paper in Chinese to introduce the Pedometrics. So I really hope more and more Chinese soil scientist will know and like pedometrics.

What recent paper in pedometrics has caught your attention and why?

My interests focus on the two aspects: integrated remote sensing and geostatistics, and soil variability in 3-D space (soil profile). Modern remote sensing approaches have advantages over conventional field survey techniques, which are labour-intensive and costly. Especially, with the development of new high spatial and spectral resolution sensors, remote sensing will provide much more useful data for pedometrics research. Gertner et al. (2007) reported a sampling and mapping method which was developed by integrating stratification and an up-scaling method from geostatistics — block cokriging with Landsat Thematic Mapper imagery. This method was used to map the vegetation cover factor related to soil erosion. The results showed that it significantly increased the unit cost-efficiency of sample data for mapping. As to my point, how to extract more prior information of ground (including surface soil) from the remotely sensed data with mixed pixels is an essential step for these studies. Another interest is pedometrics in 3-D soil profiles. Oleschko et al. (2008) describe how they mapped the soil fractal dimension in agricultural fields with GPR. Their experiments showed the scope to combine fractal analysis on GPR data with routine geostatistics (kriging).

Gertner G, Wang G, Anderson A B et al. 2007. Combining stratification and up-scaling method-block cokriging with remote sensing imagery for sampling and mapping an erosion cover factor. Ecological Informatics 2, 373–386.

Oleschko K, Korvin G, Munoz A et al. 2008. Mapping soil fractal dimension in agricultural fields with GPR. Nonlinear Processes in Geophysics 15, 711–725.

What problem in pedometrics are you thinking about at the moment?

At present, my attention is on how to map the spatial variation of soil properties in 3-D profile by nondestructive and quick techniques (like GPR, EM38 etc.). As we all known, soils are three-dimensional bodies with properties that can vary greatly over small distances in every direction. However, soils are generally investigated in only the horizontal dimensions. In my experimental site in a coastal saline area, the most serious threat to crops is the presence of soluble salts in the subsoil between 1 and 2 m deep. So only to explore the spatial variability of surface soil is not enough. We need to develop new theory and methodology in pedometrics to study soil bodies in three dimensions. Professor Richard Webster discussed in our recent work with me. There are several reasons why pedometricians have been reluctant to study soil properties in three dimensions at the field scale. One is the difficulty of visualization; how do you display the results of three-dimensional interpolation? It is surmountable; miners and petroleum engineers have had to overcome it. Another is the gross anisotropy, with differences in scale of several orders of magnitude between lateral and vertical distances. Strong drift in the vertical dimension adds to the difficulties.

What big problem would you like pedometricians to tackle over the next 10 years?

Most quantitative methods in pedometrics are based on the statistical model. Therefore, how to collect more accurate data at different scales is a key issue for building and validating models. Actually, till now most of us are still disturbed by the problems of soil sampling and soil variability. Due to the complexity and variability of soil properties, a limited amount of soil sampling will bring results with substantial uncertainty to our models. So I think that pedometricians should pay more attention to combining advanced equipment and pedometrical methods to acquire precise first-hand soil information. Especially, we should notice the new generation of remotely sensed data, such as the high spatial resolution microwave image (Terra SAR), laser remote sensing, high spectral resolution VIS/NIR image (Hyperion),and so on. Our pedometricians can work on scale transformation, sample design, pixel-based variability, and extraction of soil information from images. So I believe that remote sensing methods will play a key role in soil science at larger scales in the next 10 years.

Non-Pedometrician profile

John Crawford

The University of Sydney, Australia

How did you first become interested in soil science?

Like all good scientific careers, it all began over a cup of coffee. I had been working on aggregation in another field altogether (galaxy clustering actually) and had recently arrived at the Scottish Crop Research Institute to establish a new theoretical biology group. Iain Young and I got talking about soil structure and whether you could relate the nature of physical structure to function and dynamics of the system. That was it for about 20 years.

What are the most pressing questions at the moment in your area of soil science?

I think the most pressing questions relate to the processes that maintain soil in state that is suited to indefinite primary production. It is pretty clear that we don't understand the dynamics of soil and what drives it. I am interested in the role of the forces that organise soil at the scales relevant to key functions such as hydraulic properties and oxygen movement. In that respect I am focussing on the role of interactions between microorganisms and the physical properties of soil including its structure.

What statistical and mathematical methods are used in your area of soil science?

The characterisation of physical structure using geostatistical methods including fractal and mutlifractal models of scaling play an important role in linking pore scale dynamics to function at the core scale and above. However the fusion of process models such as computational fluid dynamics and diffusion equations are also required and the challenges of solving these in complex porous media are substantial. On top of that we need to understand how the complex and dynamic microhabitat of soil impacts on the microbial communities and what the consequences are for their functioning. The kinds of evolutionary ecological models that are required are still underdeveloped.

Are you aware of any work by pedometricians that might be relevant to your science?

Pedometrics is very much at the heart of a lot of this work and can play an important integrative role across all disciplines in soil science. In particular work that links soil structure measurements to functional aspects is important. Perhaps most important of all, is the large body of statistical methodology for scaling properties and processes. I see the challenge of linking pore scale to core scale as being particularly significant and progress in this area will make a significant impact.

What big problem would you like pedometricians to tackle over the next 10 years?

Soil is essentially an interdisciplinary science. As scientists we know a lot about the incredible physical, biological and chemical complexity of soil and knowledge in each area is growing every year. Much of this knowledge has been put to good use, but I believe more attention should be paid to synthesis. I believe we need to work towards some kind of "systems model" of soil that expresses how the different components relate to each other, how they interact, and how that affects how soil as a system changes over time. Pedometrics is a vital tool in bridging scales and disciplines to develop such a framework.

Pedomathemagica, Pedometrics 2009 Special

Ancient and Modern: Two questions with historical roots (proposed by Murray Lark) and a third proposed by Jaap de Gruijter.

Delegates to the Pedometrics 2009 meeting are invited to submit their solutions to Murray no later than 30 minutes before the start of the conference dinner. There may be a prize if Rothamsted Library has been throwing books out lately.

1. Two soil surveyors, Alf and Bert, are out in the field digging pits at locations selected independently and at random by a pedometrician, (and doing so in the original random order). It is known that soil profiles in the region contain an iron pan with probability of exactly 0.5. In one pit the surveyors discover a hoard of 80 identical gold coins. They decide to play a game to decide who will keep them. Starting from the next pit Alf will bet that the soil profile will contain an iron pan, and Bert will bet that it won't. This bet is fixed in advance, and will hold for each pit (which, you will remember, are at independent random locations). The first person to win six bets will keep the coins. After they examine eight more pits Alf has won five games and Bert has won three. At this point a thunderstorm begins and they head for the local pub. The storm continues, and after a few pints they agree that they will make up their remaining pit descriptions in front of the fire rather than getting wet. But how should they divide the coins? They agree that they should divide them in the ratio p_a:p_b , where p_a is the probability that Alf would have won the continued game, and p_b the probability that Bert would have won. Assuming that they do the sums right, how do they divide the coins?

How to divide the stake in an interrupted game of chance was much discussed in the 16th Century and played an important role in the development of probability theory — see M.G. Kendall's paper in Biometrika (1956, 43 pp 1–14).

Figure 1 Gerolamo Cardano (1501-1576) thought about this problem, but got it wrong. Can you do better?

2. A colleague, Charlie, enters the pub. He spots the gold coins and threatens to report his mates to the Director for not handing the treasure in to Finance. Alf (who is rather better mathematically educated than his colleagues) suggests that the three of them play a game the next day to decide who keeps the treasure. All three of them will go to another landscape where the probability of finding an iron pan in a pit is known to be exactly ⅓. Alf will dig a pit at a random location, if it contains an iron pan, then he will keep the treasure. If not, then Bert will dig the next pit at an independent random location, and if there is an iron pan then Bert will keep the treasure, and so on until one of them wins. Bert and Charlie agree. What are the respective probabilities that Alf, Bert and Charlie will win?

Figure 2 Christiaan Huygens

This is a version of the second problem in Christiaan Huygens's *On Reckoning in Games of Chance* (1657), interpreted as an exercise in random sampling with replacement (which Huygens leaves ambiguous). Fermat and Pascal wrote some of the problems in the book in addition to ones by Huygens himself. I do not know who invented this problem.

3. Alf wins the coins, and decides to attend the Pedometrics conference. A total of 128 pedometricians attend the conference dinner. The chairs are numbered 1 through 128. The pedometricians are also assigned a number between 1 and 128. As they come into the room one by one, they must sit at their assigned seat. However, Alf, having taken the remainder of his coins to the bar, is so drunk that he ignores the rule and takes an arbitrary seat. Any sober pedometrician who comes in and finds his seat taken also takes an arbitrary one. Alf is one of the first 64 pedometricians. What is the probability that the last pedometrician gets to sit in the chair assigned to him?