Sands, Gary R., and T. H. Podmore. 1993. Development of an environmental sustainability index for irrigated agricultural systems. In: Integrated resource management & landscape modification for environmental protection; Proceedings of the International symposium; Pp. 71-80. Kent J. Mitchell,editor. St. Joseph, MI: American Society of Agricultural Engineers.

Sustainability is one of the premier issues currently being faced by agriculture. While qualitative definitions of sustainability abound, quantitative definitions and measures have a scant presence in the literature. This paper presents the conceptual framework for the development of an environmental sustainability index for irrigated agricultural systems. The objective of the proposed index is to quantify, from an environmental prespective, the sustainability of irrigated agricultural systems.
A systems approach is a prerequisite for tackling the issue of sustainability. A three-pronged framework for characterizing environmental sustainability is conceptualized and discussed herein. The framework comprises: (i) indicators of inherent soil productivity of the system; (ii) indicators fo the agricultural system's potential to degrade the surrounding environment, and; (iii) indicators of ecosystem stability, from an energetic standpoint. The selection of various sustainability indicators within the aforementioned framework is outlined. Development and testing of aggregation schemes, leading to the design of the overall index is discussed. Anticipated results of application of the index are hypothesized. *--Authors' abstract, p.714.*

Sands, Gary R., and Terence H. Podmore. 2000. A Generalized environmental sustainability index for agricultural systems. *Agriculture, Ecosystems and Environment* 79: 29-41.

This paper presents the design and development of an Environmental Sustainability Index (ESI) and describes a case study used to evaluate the performance of the index. The objective of the index was to provide a modelling-based, quantitative measure of sustainability from an environmental perspective, comprising both on- and off-site environmental effects associated with agricultural systems. A performance approach was utilized for the ESI, having inputs that were derived from long-term simulations of crop management systems with the EPIC model (Erosion Productivity Impact Calculator). 15 sub-indices for representing sustainability were chosen employing a dual framework for characterizing environmental sustainability, embodying the agricultural system's: (i) inherent soil productivity and groundwater availability; and (ii) potential to degrade the surrounding environment. A case study was developed based on prevalent corn and wheat agricultural production systems in Baca County, located in southeastern Colorado. Principal components analysis was employed to assess the information content of the 15 sustainability sub-indices. Sensitivity analysis was performed to evaluate the effects of model input uncertainty on the index. The effect of the time frame over which the index is computed was also examined for time frames ranging from 50 to 300 years. Results show that the ESI is capable of demonstrating clear differences among crop management systems with respect to sustainability.

Sarrantonio, M., J. W. Doran, M. A. Liebig, and J. J. Halvorson. 1996. On-farm assessment of soil quality and health. In: Methods for assessing soil quality; Pp. 83-107. J. W. Doran, and A. J. Jones,editors. Madison, WI: Soil Science Society of America.

Saviozzi, A., R. Levi-Minzi, R. Cardelli, and R. Riffaldi. 2001. A Comparison of soil quality in adjacent cultivated, forest and native grassland soils. Plant and Soil 233, no. 2: 251-259.

"In Italy, there is a growing interest in estimating the cropping-induced changes in soil fertility parameters. The objective of this study was to identify soil properties that can be used as indicators for evaluating changes in soil quality after 45 years of continuous production of corn by the conventional tillage method as compared with adjacent forest and native grassland sites." (p.252).
There are problems with the methods used in this study (--ch notes). The 1997 data is from 3 plots, each 0.1ha area; (cropped, forest, and supposedly 'virgin' grassland soils compared); measured: organic C, SOM, microbial biomass, respiration, enzyme activity (protease, Beta-glucosidase, urease, alkaline phosphatease, dehydrogenase, catalase); Results from all sandy-loam soils; texture & pH, subalkaline not much 'changed' (i.e. differing); organic C showed "significant change", & C/N ratio of cropped land lower than forested or grassland soils. This is an attempt at Trends Analysis in organic carbon; but not appropriate for single-season testing. Methods useful only if follow-up tests done over subsequent years (need a 'baseline'; must argue 'change' is equivalent to different ecosystem soils as different temporal representatives; flaw in logic, as soil chemistry and soil physical properties will be variable and different from within each ecosystem in a given year; --Static study.--(ch notes).

Schenck, R. C. 2001. Land use and biodiversity indicators for life cycle impact assessment. International Journal of Life Cycle Assessment—Special Issue [of the]:International Conference and Exhibition on Life Cycle Assessment: Tools for Sustainability, Arlington, Virginia, USA, 25-27 April 2000 6, no. 2: 114-117.

A workshop was conducted in July 2000 by the Institute for Environmental Research and Education and its partner, Defenders of Wildlife, to develop a preliminary list of life cycle indicators for land use impacts. The preliminary list of impact indicators includes: protection of priority habitats/species; soil characteristics; soil health; proximity to and protection of high priority vegetative communities; interface between water and terrestrial habitats/buffer zones; assimilative capacity of water and land; hydrological function; per cent coverage of invasive species within protected areas; road density; per cent native-dominated vegetation; restoration of native vegetation; adoption of best management practices linked to biodiversity objectives; distribution (patchiness, evenness, etc.); and connectivity of native habitat. It is concluded that the list of indicators conforms well to other efforts in developing indicators. *--CAB Abstracts.*

Schoenholtz, S. H., H. van Miegroet, and J. A. Burger. 2000. A Review of chemical and physical properties as indicators of forest soil quality: Challenges and opportunities. *Forest Ecology and Management* 138, no. 1/3: 335-356.

Complete literature review and discussion of the concept of soil quality, indicators (See Tables), and applicability of agricultural studies to forest soils and forestry research/models. Literature is usefully presented with soil quality indicators and soil properties in table format, to assist readers.

Schwenke, G. D., D. J. Reuter, R. W. Fitzpatrick , J. Walker, and P. O'Callaghan. 2003. Soil and catchment health indicators of sustainability: case studies from southern Australia and possibilities for the northern grains region of Australia ; Application of sustainability indicators to the management of soil and catchment health. Australian Journal of Experimental Agriculture 43, no. 3: 205-222.

During the last decade, a range of indicators has been advocated for assessing soil, farm and catchment health. This paper assembles some recent experiences of the authors in developing and using indicators from paddock to national scales. Indicators are merely a subset of the attributes that are used to quantify aspects of catchment or farm health. Their selection and use in the past has led to criticism of indicators, but, given an explicit approach, most of the criticisms can be overcome. Reliable indicators provide positive and negative signals about the current status of natural resources and how these properties have changed over time. They are used both to identify potential risks and to confirm that current farming practices and systems of land use are effective in maintaining the resource base or economic status. They should be precursors for change and future on-ground investments when problems are observed or identified. A structured approach is needed to ensure indicators are selected and used efficiently. This approach involves: deciding local issues and selecting the most appropriate indicators to reflect those issues; interpreting both positive and negative signals from the monitoring process; taking appropriate action to resolve problems; and, using indicators to monitor the outcomes from the action taken. Finally, we have drawn on these and other experiences to compile a list of indicators that may be used to address sustainability issues associated with farm productivity, soil health and catchment health identified in recent strategic plans developed for the northern grains region of Australia, the focus of this special journal issue. *--CAB Abstracts.*

Scottish Environmental Protection Agency (SEPA). 2001. Soil Quality Report 2001 -- a State of the Environment report. From URL: http://www.sepa.org.uk/publications/stateoftheenvironment/soil/index.htm

Publication Announcement : State Of The Environment : Soil Quality Report...
Launch of the SEPA State of the Environment: Soil Quality Report [was] 4 April 2001.
--From URL: http://www.sepa.org.uk/publications/stateoftheenvironment/soil/index.htm -- *Online abstract.*

Scrivner, C. L. 1999. "Soil productivity indices and soil properties of some major soil series of the Missouri Ozarks." Report no.EC955. Columbia, MO: University of Missouri-Columbia, University Extension. From URL: http://muextension.missouri.edu/explore/extcirc/ec0955.htm

This publication provides information and tables for estimating the potential productivity of several soils in

the Ozarks. The system, designed by three soils scientists, is based on a productivity index (PI). It uses three properties — the potential available water capacity, bulk density and soil acidity (pH) — to determine the PI. Each of the 11 major Ozarks soil series is outlined in this publication. *--From URL:* http://muextension.missouri.edu/explore/extcirc/ec0955.htm ; accessed Oct.15, 2003.

Scrivner, C. L., B. L. Conkling, and P. G. Koenig. 1999. "Soil productivity indices and soil properties for farm-field sites in Missouri ." Report no.EC947. Columbia, MO: University of Missouri-Columbia, University Extension.

Farm-level field plots and soils testing in Missouri; tabular presentation of results; designed for on-farm use. " This report summarizes soil data collected from 500 field plots in Missouri." --From URL: http://muextension.missouri.edu/explore/extcirc/ec0947.htm

Seybold, C. A., and J. E. Herrick. 2001. Aggregate stability kit for soil quality assessments. Catena—Special Issue [of the] Workshop on Soil Aggregation in Arid and Semi-Arid Environments, Las Cruces, New Mexico, USA 8-10 May 1997 44, no. 1: 37-45.

Aggregate stability affects soil strength, and the soil's ability to transmit liquids and gases, which are important functions for crop production and ecosystem health. Aggregate stability can be used to assess soil quality because it is an indicator of vital soil functions. For soil quality assessments, there is a need for a quantitative field method for measuring aggregate stability that is simple to perform, low cost, and available for routine assessments by land managers. A method that follows the commonly used or standard single-sieve wet-sieving method for aggregate stability is presented. *--Authors' abstract.*

Seybold, C. A., M. J. Mausbach, D. L. Karlen, and H. H. Rogers. 1998. Quantification of soil quality. IN *Soil processes and the carbon cycle*. R. Lal, J. M. Kimble, R. F. Follett, and B. A. Stewart, 387-404. Boca Raton , FL: CRC Press Inc.

The five soil functions of Karlen et al. (1997), as well as of Larson and Pierce (1991), and the functional definition for soil quality by Doran and Parkin (1994) are all outlined, in this solid review and discussion of frameworks for soil quality assessment.

Sherwood, Stephen, and Norman Uphoff. 2000. Soil health: research, practice and policy for a more regenerative agriculture. Applied Soil Ecology [Elsevier Science B.V.] 15, no. 1: 85-97.

Sikora, L. J., C. A. Cambardella, V. Yakivchenko , and J. W. Doran. 1996. Assessing soil quality by testing organic matter. IN Soil organic matter : Analysis and interpretation; Pp.41-50. F. R. Magdoff et. al. editors. Madison, WI: Soil Science Society of America.

Singh, K. K., T. S. Colvin, D. C. Erbach, and A. Q. Mughal. 1992. Tilth Index : an Approach towards soil condition quantification // Tilth Index : an Approach to quantifying soil tilth. Transactions of the ASAE—ASAE Meeting Papers, American Society of Agricultural Engineering, 6 (Nov-Dec) St. Joseph, MI: ASAE.

Classic paper which sets out to quantify 5 soil physical properties: bulk density, cone index, aggregate uniform coefficient, organic matter content, and placticity index; and combine into a single index so as to characterize soil tilth from a value of 0 (unusable by plants) to 1 (non-limiting for crop growth). The Soil Tilth Index is a multiplicative combination of coefficients for the soil properties. This developed from 1989 July tests from 4 locations in field plots of corn with chisel-plow, moldboard plawing and slot plant ridge systems. Crop yields were measured 9189 and 1990. A corn-soybean rotation was used in 1990. The study compared mean values of crop yields and tilth indices for a Waseca, Minnesota Webster clay-loam soil, finding positive correlation.

Smart, Peter, and International Standards Organisation. 2003. ISO 10381: Soil quality: sampling. Peter Smart. From URL: http://www.eng.gla.ac.uk/~gnca11/sme/isotc190.html The international standards for soil quality are listed on this useful web link.

Smith, Jeffrey L., Jonathan J. Halvorson, and Robert I. Papendick. 1993. Using multiple variable

indicator kriging for evaluating soil quality. Soil Science Society of America Journal 57, no. 3 (May/Jun): 743-749.

———. 1994. Multiple variable indicator kriging : a Procedure for integrating soil quality indicators. Chapter 9. IN Defining soil quality for a sustainable environment; Proceedings of a symposium. Pp.149-158. J. W. Doran, D. C. Coleman, D. F Bezdicek, and B. A. Stewart, editors. Soil Science Society of America.

> "Kriging" is a statistical method to transform values above or below arbitrarily-selected data thresholds in multivariate non-ranked data sets, in order to examine correlations of variables. It is not easily replicable or applicable by farmers without expertise/assistance (--ch notes). Soil indicators for 3 parameters from 60 locations in a triangular grid on a 100m x 100m field, measured in millograms per kilogram, labelled A, B & C. (Not told where or what these were!--ch notes). Maps of probability are then "kriged" from data; the result is a probability index and not a unit index. Field level, small-scale, of "risk-qualified" parameters is given; but, a complex method for farmers to apply (--ch notes). Presence/absence around a 'critical threshold' used to derive data, which are replicable, but measurement methods are not apparent from this published presentation of the research. (--ch notes).

Soil Quality Institute. 2001. “What is soil quality?” Web page, Available at URL: http://www.statlab.iastate.edu/survey/SQI/sqw.html ; Accessed September 11, 2003.

Soil Quality Institute. 2003. “About soil quality [NRCS SQI web site].” Web page, Available at http://soils.usda.gov/sqi/soil_quality/index.html ; Accessed September 11, 2003.

Sojka, R. E., and D. R. Upchurch. 1999. Reservations regarding the soil quality concept . Soil Science Society of America Journal 63, no. 5 (Sept-Oct): 1039-1054. This discussion paper presents the viewpoint that 'soil quality' is conceptually flawed.

Sojka, R. E., D. R. Upchurch, and N. E. Borlaug. 2003. Quality soil management or soil quality management: Performance vs. semantics. Advances in Agronomy; Vol. 79: 1-68. Donald L. Sparks, editor. New York, NY: Academic Press.

> This comprehensive 'philosophy of science' review of the soil quality concept (2003) expresses serious reservations, opposes the position of Karlen et al. (1997) categorically, advocates dangers of the 'soil functionalism' and reductionist paradigms, and 'quality soil management' versus 'soil quality management'. These authors take the position that current efforts at soil quality index development, application, and interpretation are flawed, require deconstruction to make sense of their data, are not indicative of management needs, do not accurately reflect reality, are impossibly complex for farmers and managers to use, and are paradigmatically a wasted effort in agricultural science. The paper is an excellent summary of the current issues related to soil quality indexing, esp. the "institutional definition of soil condition or health (Mausbach & Tugel 1995), and definition issues re SQ, soil health, 'transient soil status' (p.45). "Integrated indexing of simultaneous functions has not been achieved" according to the authors (p.52); they advocate management solutions, not indexing efforts, in further soils research endeavours. This will continue to be an important position paper in the 'soil quality vs. quality soil' debate for some time to come.

Southorn, Neil, and Stephen Cattle. 2000. Monitoring soil quality for Central Tablelands grazing systems. Communications in Soil Science and Plant Analysis 31, no. 11-14: 2211-2229.

Southourn, N. J. 2002. The Role of soil quality criteria in assessing farm performance . Proceedings of the International Farm Management Congress.

> The environmental impact of industrial agriculture is under close scrutiny, by Governments, concerned citizens, and farmers. This paper discusses the need to incorporate environmental factors in measures of farm performance, as part of the continuous review of long term sustainability. The concept of natural capital allows natural resources to be considered in similar ways to other assets of the farm business. It is suggested that soil quality criteria, selected to match the site characteristics and purpose of the landowner, be included in these measures, despite continuing disagreement about the conept and difficulties in its applicaiton. The intuitive appeal of a soil quality paradigm is the potential to integrate the many dimensions of sustainability,

encouraging responsible land management. It is further suggested that soil sturcture is a key indicator of soil quality, and methods for its assessment are summarized. *--Author's abstract, p.1.*

Sparks, Donald L., editor. 2001. Advances in Agronomy., Vol. 74. New York, NY: Academic Press.

Volume 74 contains six excellent cutting-edge reviews detailing advances in the plant and environmental soil sciences. Chapter 1 is an extensive review on soil quality.[by Karlen, Douglas L.//Andrews, Susan S.//Doran, John W.]. Chapter 2 covers recent advances in understanding the formation of metal hydroxide precipitates on soil surfaces and their implications on metal sequestration and soil remediation. Chapter 3 is a timely review on effects of organic acid exudation from roots on phosphorus uptake and aluminum tolerance of plants in acid soils. Chapter 4 discusses bamboo production and management, including manipulation of growth and development and environmental aspects of bamboo production. Chapter 5 addresses a significant worldwide issue - management of soils for food security and environmental quality. Chapter 6 is a comprehensive review on the management of wheat, barley, and oat root systems. *-From the Advances in Agronomy website at URL:* **http://www.harcourt-international.com/catalogue/title.cfm --Accessed Sept.09.2003.**

Sparling, Graham P. 2002. Soil quality assessed at 500 sites nationwide. Soil Horizons , no. 7 (Mar): 1-2. This article is about the '500 soils project' of New Zealand.

Sparling, Graham P., Wim Rijkse, Hugh Wilde, Tony van-der Weerden, Mike Beare, and Glyn Francis. 2002. *Implementing soil quality indicators for land*. Research Report for 2000-2001 and Final Report for MfE Project Number 5089, Landcare Research Contract Report: LC0102/015. Ministry for the Environment Sustainable Management Fund, New Zealand.

This article is about the '500 soils project' of New Zealand. From URL: http://www.smf.govt.nz/results/5089_report00_01.pdf ; Accessed February 4, 2002.

Sparling, Graham P., and L. A. Schipper. 1998. *Final Report: Trialing soil quality indicators for state of the environment reporting* (SMF Project 5001), Landcare Research Contract Report: LC9798/146 for SMF Project 5001. Landcare Research, New Zealand.

The 500 soils project of New Zealand is discussed. Soil quality indicators that are required, at minimum, and paired soil types, are identified for the development of a soil quality monitoring program for New Zealand; semantically, aggregates of indicators are called 'indices'.

———. 1998. Soil quality monitoring in New Zealand : Concepts, approach and interpretation, Technical Report LCR 9798/060. Landcare Research, New Zealand, 500 soils project, New Zealand. From URL: http://www.smf.govt.nz/results/5001_handbook.pdf ; Accessed February 4, 2002

———. 2002. Soil quality at a national scale in New Zealand. Journal of Environmental Quality—Ecological Risk Assessment Section 31, no. (Dec): 1848-1856.

The 500 soils project of New Zealand is discussed. Researchers used their own sources to produce quantitative, valid, & verifiable data. This New Zealand study of 222 sites is an overall soil survey in 5 regions, at regional scale for a national assessment. The article abstract provides details of soil attributes compared. Field data for standard soil chemical properties (total C, total N, CEC, base saturation, Olsen Phosphate, pH) was collected. Applied analysis of variance and principal component analysis statistical methods to soil properties; frequency analysis compared to national '500 Soils' data set was used to determine representativeness of soil samples, and to rationalize data over land use, soil type, and eco-region variables. Data value ranges are reported and graphed using box plots. Data interpretation is presented by land use category. Report is for 2/3rds of project completion; included finding similar SQ patterns across similar land use, in all regions, despite different soils and climates (p.1856). "Suite of indicators" approach--No single index developed or applied to the data interpretation.

Steiner, Kurt G., Heidrun Traeger, and Anna Haering. 2001. Indicators of sustainable land management, Deutsche Gesellschaft fur Technische Zusammenarbeit, Eschborn, Germany. From URL: http://www.gtz.de/soil-management/english/english/publik.htm

Stenberg, Bo. 1999. Monitoring soil quality of arable land : Microbiological indicators ; Review article. Acta Agriculture Scandanavia—Section B: Soil and Plant Science 49, no. 1: 1-24.

This review discusses the soil quality concept, indicators of soil quality and ways for selecting, sampling to monitor SQ, with a framework developed for Sweden, based on microbiological indicators.--ch.
Comment on paper: "Informative notes, very good information."--jw.

Stenberg, Bo, Mikael Pell, and Lennart Torstensson. 1998. Integrated evaluation of variation in biological, chemical and physical soil properties. Ambio [Royal Swedish Academy of Sciences] 27, no. 1 (Feb): 9-15.

Sweden, Bavaria; --1995 spring samples were collected from an experimental farm in Sweden to 10 cm depth, from point samples on mesh grid with intersects resampled spring 1996 to a 90cm depth at 3 intervals; moldboard plowing & crop rotations in fields, for total C, N & S. --1991 to 1993 samples randomly selected from among 228 air-dried samples of 26 soils from throughout Sweden, for pH, infrared reflectance -- to represent CEC, SOM, & clay content. Then in 1995 resampling in late winter/early srping in-field on these selections, at 290cm depth from a 10 to 50 m^2 area; sieved, stored in labs/frozen, and analyzed within one yhear for soil microbial biomass. --High variability, high pH in most soils. (PCA analyses seem disjointed--ch notes).

Stephens, Peter R. 1999-2003. Soil quality and functioning of ecosystems: Research outline for Soil quality programme. Manaaki Whenua Landcare Research, New Zealand.

The programme [by LandCare Research in New Zealand] will develop critical thresholds of soil quality indicators, and an associated regional scale monitoring system for their use, to determine trends in soil quality and soil ecosystem health. The programme also includes research investigating the response of soil ecosystems to urbanisation.
The underpinning research has been realigned to focus on determining the impact of land-use pressures on resistance and resilience of key soil orders, and, in later years, soil ecosystem functioning. Land uses comprise grassland, forestry, arable, urban and organic farming. Investment is being made to better understand and facilitate the interaction between researchers and end-users, and how knowledge and information are used for sustainable management of soil ecosystems. Key end-users comprise regional councils and government agencies concerned with environmental issues. -- **From URL:**
http://www.landcareresearch.co.nz/research/rurallanduse/soilquality/ProgOutline.asp

Stephens, Peter R., A. E. Hewitt, G. P. Sparling , R. G. Gibb, and T. G. Shepherd. 2003. Assessing sustainability of land management using a risk identification model. Pedosphere 13, no. 1: 41-48.

New Zealand is highly dependent on its soil resource for continued agricultural production. To avoid depleting this resource, there is a need to identify soils and associated land management practices where there is a risk of soil degradation. Environmental integrity and ecosystem services also need to be maintained. Accordingly, to ensure sustainable production, the on- and off-site environmental impacts of land management need to be identified and managed. We developed a structural vulnerability index for New Zealand soils. This index ranks soils according to their inherent susceptibility to physical degradation when used for agricultural (pasture, forestry and cropping) purposes. We also developed a rule-based model to assess soil compaction vulnerability by characterizing the combined effects of resistance and resilience. Other soil attributes have been appraised using seven chemical, physical and biological indicators of soil quality (total C, total N, mineralizable N, pH, Olsen P, macroporosity and bulk density). These indicators have been applied in a nation-wide project involving data collection from over 500 sites for a range of land uses. These soil quality data can be interpreted through the World Wide Web - through the interactive decision-support tool SINDI. The land use impact model is a framework to assess agricultural land management and environmental sustainability, and may be applied to land units at any scale. Using land resource data and information, the model explicitly identifies hazards to land productivity and environmental integrity. It utilizes qualitative expert and local knowledge and quantitative model-based evaluations to assess the potential environmental impacts of land management practices. The model is linked to a geographic information system, allowing model outputs, such as the environmental impacts of site-specific best management practices, to be identified in a spatially explicit manner. The model has been tested in New Zealand in an area of pastoral land use. Advantages of this risk identification model include: utilizing current knowledge of the causes and effects of land management practices on soil degradation; linking land management practice to both on- and off-site environmental consequences; identifying important gaps in local knowledge; and providing spatially explicit information on the environmental impact of land management practices. *--Authors' abstract, p.41.*

Stockle, C. O., R. I. Papendick, K. E. Saxton, G. S. Campbel, and van-Evert F. K. 1994. A Framework for evaluating the sustainability of agricultural production systems. American Journal of Alternative Agriculture 9, no. 1&2: 45-50.

[In this discussion paper, we learn that:] Sustainable agriculture has gained acceptance as a conceptual approach for shaping farming systems of the future. All definitions of sustainable agriculture include food productivity, food safety, resource protection, quality of life and environmental quality. However the sustainability of a wide range of farming systems has been judged only subjectively. Currently there are no scientific criteria to evaluate the sustainability of a specific farming system. We propose a framework for evaluating the relative sustainability of a farming system using nine attributes: profitability, productivity, soil quality, water quality, air quality, energy efficiency, fish and wildlife habitat, quality of life, and social acceptance. Each attribute is scored and then weighted in a way that is subjective and dependent ont he judgment of the evaluating team, but that must be expressed numerically. The scoring must be based on quantifiable constraints within each attribute. Constraints can be quantified by direct measurement, which is already true for those related to profitability, productivity, water quality and energy efficiency. Constraints that are not readily measurable will need other evaluation techniques, including expert opinion and computer simulation models. *--Authors' abstract, p.45*.

Stott, D. E., R. H. Mohtar, and G. C. Steinhardt , editors. 2001. Sustaining the global farm—Selected papers from the 10th International Soil Conservation Organization Meeting (ISCO99), 24-29 May 1999, West Lafayette, Indiana. West Lafayette, IN: International Soil Conservation Organization in cooperation with the USDA and Purdue University. 688pp. From URL: http://topsoil.nserl.purdue.edu/nserlweb/isco99/pdf/ISCOdisc/tableofcontents.htm ; Accessed Oct.17.2003 (ch).

Straalen, N. M. van. 1997. Community structure of soil arthropods as a bioindicator of soil health. Biological indicators of soil health; Pp. 235-264. C. Pankhurst, B. M. Doube, and V. V. S. R. Gupta, editors. Wallingford, UK: CAB International.

The concept of community bioindicators for soil health is outlined. Possible microarthropod community indicators are considered based on a classification after species abundance, dominance, life histories, feeding types and physiotypes. The stability of soil microarthropod communities is discussed. Ways in which the ecology of the species can be exploited to optimize the indicator value of the microarthropod community are examined. The indicator value of ecological groupings is discussed. The soil factors for which microarthropod community indicators may be useful include soil type, humus type, microbial populations, pH, humidity, temperature, nutrient status, heavy metals, and pesticide residues. --*CAB Abstracts.*

Straalen, N. M. van. 2002. Assessment of soil contamination—a functional perspective. *Biodegradation*—Special Issue on *Resilience of the Subsurface Ecosystem to Anthropogenic Disturbances*; OECD Meeting, Amsterdam, Netherlands, 27-28 August 2001 13, no. 1: 41-52.

In many industrialized countries the use of land is impeded by soil pollution from a variety of sources. Decisions on clean-up, management or set-aside of contaminated land are based on various considerations, including human health risks, but ecological arguments do not have a strong position in such assessments. This paper analyses why this should be so, and what ecotoxicology and theoretical ecology can improve on the situation. It seems that soil assessment suffers from a fundamental weakness, which relates to the absence of a commonly accepted framework that may act as a reference. Soil contamination can be assessed both from a functional perspective and a structural perspective. The relationship between structure and function in ecosystems is a fundamental question of ecology which receives a lot of attention in recent literature, however, a general concept that may guide ecotoxicological assessments has not yet arisen. On the experimental side, a good deal of progress has been made in the development and standardized use of terrestrial model ecosystems (TME). In such systems, usually consisting of intact soil columns incubated in the laboratory under conditions allowing plant growth and drainage of water, a compromise is sought between field relevance and experimental manageability. A great variety of measurements can be made on such systems, including microbiological processes and activities, but also activities of the decomposer soil fauna. I propose that these TMEs can be useful instruments in ecological soil quality assessments. In addition a "bioinformatics approach" to the analysis of data obtained in TME experiments is proposed. Soil function should be considered as a multidimensional concept and the various measurements can be considered as indicators, whose combined values define the "normal operating range" of the system. Deviations from the normal operating range indicate that the system is in a condition of stress. It is hoped that more work along this line will improve the prospects for ecological arguments in soil quality assessment. --*CAB Abstracts.*

Suyundukov, Y., and S. Yanturin. 2000. Agroecological optimization of Bashkir Trans-Ural soil utilization. Mezhdunarodnyi Sel'Skokhozyaistvennyi Zhurnal, no. 3: 41-46.

Agroecological indexes (e.g. humus, organic fertilizers in soils, erosion risk) associated with various tillage methods (terracing and non-terracing plough, zero tillage) were examined in the optimization of the fallow system, rotational structure with conservation and reproducibility of fertility by soil tillage in the title area of Russia. Soil restoration was possible with the planting of mixed grass, and the use of ecological organic irrigated farming. -- *CAB Abstracts.*

Switzerland. SAR. 2003. SAR research projects : 1.1 Natural resources, environmental protection in agriculture. From URL: http://www.sar.admin.ch/en/research/subject_area/1_1.html

We links to the Research projects of the six Swiss federal research stations in the field of agriculture [regarding] soil quality, soil fertility, soil analytical method, soil quality indicator, sustainability ... SAR - Forschungsprojekte - Projektsuche über Schlagwörter Sitemap Copyright © 1999 SAR http://www.admin.ch/sar/ Forschungskatalog 2000 - 2003 Projektsuche überwww.sar.admin.ch/de/research/keyword_index.html