Lal, Devendra. 2001. New nuclear methods for studies of soil dynamics utilizing cosmic ray produced radionuclides. In: Sustaining the global farm—Selected papers from the 10th International Soil conservation Organization Meeting (ISCO99). D. E. Stott, R. H. Mohtar, and G. C. Steinhardt, editors. West Lafayette, IN: International Soil Conservation Organization, in cooperation with the USDA and Purdue University. From URLs: http://topsoil.nserl.purdue.edu/nserlweb/isco99/pdf/isco99pdf.htm/ ; **Referenced at:** http://www.oecd.org/dataoecd/28/27/1890358.htm

Larson, W. E., and F. J. Pierce. 1991. Conservation and enhancement of soil quality. In: Evaluation for sustainable land management in the developing world, Volume 2: Technical papers. Thailand.

> An important and often-quoted discussion paper, outlining pedotransfer functions of soil attributes, with definition of soil quality as the "capacity of soil to function...". This article presents the definitive elements of soil quality (p.177).--ch.

———. 1994. The Dynamics of soil quality as a measure of sustainable management. Chapter 3 In: Defining soil quality for a sustainable environment; Pp.37-52. J. W. Doran, D. C. Coleman, D. F Bezdicek, and B. A. Stewart, editors. Soil Science Society of America.

> Larson and Pierce (1991, 1994) propose that a minimum data set (MDS) together with a pedotransfer function (PTF) be designed to monitor soil quality changes over time. The 10 indicators of teh MDS include nutrient availability, total and labile organic C, texture, plant-available water capacity, structure, strength, maximum rooting depth, pH, and electrical conductivity. These quantify critical properties sensitive to changes in soil management practices. They note that no consensus exists yet on what an MDS should include. Because soil attributes are interrelated, one attribute often can be predicted from others. Therefore, PTFs can be used to extend the utility of the MDS to monitor soil quality. -- [*from Freyenberger's et al. annotated bibliography: SQI Lit.ID #214, p.10*]

Letey, J., R. E. Sojka, D. R. Upchurch, D. K. Cassel, K. R. Olson, W. A. Payne, S. E. Petrie, G. H. Price, R. J. Reginato, H. D Scott, P. J. Smethurst, and G. B. Triplett. 2003. Deficiencies in the soil quality concept and its application. Journal of Soil and Water Conservation 58, no. 4 (Jul-Aug).

> These authors, following the critical position of Sojka and others (1999, 2003), advocate that soil quality indexing is probably a wasted effort and can be misleading. They offer an alternative regarding the soil quality controversy, "that application of a new edaphic concept should be management outcome-based rather than soil resource indexing-based" (p.185). They do not support a numerical SQIndex approach to soil assessment.

Lewandowski, Ann, Mark Zumwinkle, and Alison Fish. 1999. Assessing the soil system : a Review of soil quality literature, Minnesota Department of Agriculture, Energy and Sustainable Agriculture, St. Paul, MN.

> Excellent summary of all ramifications of soil quality; complete review of literature up to 1999 (June); context of the indexing process is provided (pp.36-37). Indexes based upon soil functions (after Larson & Pierce 1991 & 1993) expressed as a numerical value can be used to assess change over time and space, according to the authors. Standardization of indexing uses scoring to “define the relationship between soil indicators and soil functions.” (p.37) Issues of variability, indicator selection, ranking/weighting, and use of benchmark soils are all considered and outlined in this publication.—ch.

Licht, M. A., and M. Al-Kaisi. 2002. Soil and water quality indices as affected by tillage systems. Poster presentation at: 2002 SWCS - Soil and Water Conservation Society Annual Conference. From URL: http://www.swcs.org/t_what_2002confposterpresentations.htm

> The major objectives of the study are to evaluate the effect of tillage systems (strip tillage, chisel plow, and no-tillage) on **soil quality indices** and time of nitrogen application and tillage systems on ground water quality and use efficiency. The study started with fall tillage in 2000 at two locations, with the 2001 being the first growing season. Soil samples were collected for 0-15, 15-30, 30-60, 60-90, 90-120 cm before tillage each fall. Total carbon, total nitrogen, total phosphorus, and nitrate nitrogen was determined for the 0-15 cm

depth increment; the lower depths were only analyzed for nitrate nitrogen. Soil temperature and soil compaction were recorded using a watchdog soil moisture logger and a CP-20 Rimik Penetrometer. Surface and profile soil moisture were determined volumetrically with a TRIME-FM, which uses time domain reflectometry technology. Water samples were collected from a 1.2 meter suction lysimeter. Plant samples were collected for V6, V12, VT, and R6 stages and analyzed for total carbon and total nitrogen. Plant emergence was determined for 10 days following planting, while harvest population and yield was also determined. Grain samples were then analyzed for total carbon and total nitrogen. Preliminary data showed no differences in corn yield at the Nashua location and a small advantage to chisel plowing at the Ames location. *-- MSN online abstract.*

Liebig, Mark A., and John W. Doran. 1999. Evaluation of point-scale assessments of soil quality. Journal of Soil and Water Conservation [Ankeny] 54, no. 2 (Second Quarter): 510-518.

This study evaluated four approaches to point-scale assessment of soil quality: farmers' perceptions and field-descriptive, field-analytical, and laboratory-analytical assessments. Twenty-four conventional and organic farmers were paired within ecoregions, and perceptions of soil quality indicators on their 'good' and 'problem' soils were surveyed. Using results from laboratory-analytical assessments as a standard, farmers' perceptions were accurate or near-accurate in over 75% of the cases for the majority of indicators evaluated in the study. Field-descriptive assessments of topsoil depth and soil texture were accurate or near-accurate in at least 92% of the cases. Results from field-analytical assessments of electrical conductivity, soil pH, and soil nitrate were accurate in at least 46% of the cases. From an assessment-efficiency standpoint, seeking out farmers' perceptions of soil quality indicators seems to be an appropriate first iteration to point-scale evaluations. *-- CAB Abstracts.*

Liebig, Mark A., and John W. Doran. 1999. Impact of organic production practices on soil quality indicators. Journal of Environmental Quality [Madison, WI: American Society of Agronomy] 28, no. 5 (Sept/Oct): 1601-1609.

The impact of organic production practices on soil quality indicators, for selected farms in Nebraska and North Dakota, were evaluated to better understand their effects on soil quality and sustainability. Conventional production practices were the standard to which the effects of organic production were compared. Five organic and conventional farms, matched by soil type, were chosen for the study. Soil properties recognized as basic soil quality indicators were measured on each farm at depths of 0 to 7.6 and 0 to 30.5 cm. Averaged across locations, there was 22% more organic C (12571 kg ha(-1)) and 20% more total N (970 kg ha(-1)) on organic farms than conventional farms in the surface 30.5 cm. At four of live locations, organic farms had soil pH closer to neutral, lower bulk density, and higher available-water holding capacity, microbial biomass C and N, and soil respiration as compared with conventional farms. Nutrient levels above crop needs were observed in both organic and conventional farms indicating the potential for negative environmental impacts. Despite this, organic farms often had more potentially mineralizable N (anaerobic incubation) relative to NO(3)-N in the surface 30.5 cm. For conditions of this study, the capacity of organic production practices to improve soil quality was mainly due to use of more diverse crop sequences, application of organic amendments, and less frequent tillage. *--Authors' abstract, from Agricola 1998-2003t.*

Liebig, Mark A., Gary Varvel, and John Doran. 2001. A Simple performance-based index for assessing multiple agroecosystem functions. Agronomy Journal 93: 313-318.

This is a theoretical 'methods' paper, that discusses the calculations, weighting, and scoring measures necessary to derive and sum indicator scores into an integrative index across agroecosystem functions. The procedure is designed to compare performance-based indicators in terms of management practices. Few details of the study are provided, except that fertilizer treatments, crop rotations, yields of 7 cropping systems (mainly corn on silty clay-loam soils from an experimental farm in Nebraska, over a 12-year period (with averages used) are involved. The indexing procedure "followed four basic steps: data grouping, calculation of averages, ranking and scoring treatments, and summing of scores within and across agroecosystem functions" (p.314), and used a large data set, with 12-year averages.

Linden, D. R., P. F. Hendrix, D. C. Coleman, and P. C. J. van Villet. 1994. Faunal indicators of soil quality. Defining soil quality for a sustainable environment; Proceedings of a symposium, Minneapolis, MN, USA, 4-5 November 1992J. W. Doran, D. C. Coleman, D. F. Bezdicek, and B. A. Stewart, 91-106Madison, WI: Soil Science Society of America Inc. (SSSA).

The effects of soil fauna on soil functional properties that reflect soil quality are reviewed. Each organism or group size may serve as indicators of quality. The categories of possible indicators range from individual and population density, communities including diversity and trophic associations to biological processes comprising bioaccumulation and crop residue decomposition. The specific role of earthworms is also considered.

Lindert, Peter H. 2000. Shifting ground: the Changing agricultural soils of China and Indonesia. Cambridge, MA: MIT Press. xii, 351 pp.

Lobry-de-Bruyn, L. A. 1997. The Status of soil macrofauna as indicators of soil health to monitor the sustainability of Australian soils. Ecological Economics [Amsterdam] 23, no. 3: 167-178. [Department of Ecosystem Management, University of New England, Armidale, NSW 2351, Australia]

Loveland, P., and J. Webb. 2003. Is there a critical level of organic matter in the agricultural soils of temperate regions? a review. Soil Tillage Research [Amsterdam, The Netherlands: Elsevier Science B.V.] 70, no. 1 (Mar): 1-18.

Lyons-Johnson, D. 1997. Earthworm casts reflect soil conditions. *Agricultural Research* [Washington, D.C.: Agricultural Research Service, United States Department of Agriculture] 45, no. 1 (Jan): 19.