

Ph.D. Geography
Course Structure and Syllabus
Academic Session 2017-18



Centre for Geography and Geology
Central University of Punjab
Bathinda

Syllabus for Ph.D. Course work in Geography

Course Code	Course Title	Credit Hours				% Weightage				E	CBCS
		L	T	P	Cr	A	B	C	D		
Semester-I											
Core courses											
GEO.701	Research Methodology in Geography	4	1	-	4	25	25	25	25	100	Co
GEO.702	Computer Applications-P	-	-	4	2	-	25	-	25	100	Fn
GEO.703	Geographical Information System–T	4	1	-	4	25	25	25	25	100	Co
GEO.704	Geographical Information System– P	-	-	4	2	-	-	-	100	100	Co
Elective courses: Select any one of the specialized courses listed below											
GEO.704	Population, development and environment	4	1	-	4	25	25	25	25	100	EL
GEO.705	Regional analysis with special reference to India	4	1	-	4	25	25	25	25	100	EL
GEO.706	Earth and the Environment	4	1	-	4	25	25	25	25	100	EL
GEO.707	Urban Geography and Environment	4	1	-	4	25	25	25	25	100	EL
GEO.708	Land Degradation and Desertification	4	1	-	4	25	25	25	25	100	EL
Total		16	4	8	16	-	-	-	-	500	

A: Continuous Assessment: Based on Objective Type Tests
B: Mid-Term Test-1: Based on Objective Type and Subjective Type Test
C: Mid-Term Test-2: Based on Objective Type and Subjective Type Test
D: End-Term Exam (Final): Based on Objective Type Tests
E: Total Marks

Choice Based Credit System (CBCS):

CO: Core Course
 Fd: Foundation Course
 El: Elective Course

L: Lectures T: Tutorial P: Practical Cr: Credits

Course Title: Research Methodology in Geography

L	T	P	Cr	Marks
4	1	-	4	100

Course Code: GEO.701

Unit I

Paradigms and Types of Research:

Research Paradigms: Logical Positivism, Phenomenology, Triangulation, Ethnography; Types of Research: Designing Fundamental, Applied and Action Research; Methods of Research: Historical, Experimental, Descriptive Research; Ethical Issues in conducting research.

Unit II:

Research procedure:

Review of Literature: thematic and theoretical approach, Identifying gap areas from literature review, formulation of Research Questions, Development of working hypothesis. and testing of Hypotheses, Sampling: Designing Probability and Non-Probability Sampling techniques for research problems, Reliability and Validity of qualitative and quantitative tools.

Qualitative Data Analysis: Content Analysis, Case Studies, Interviews

Quantitative Data Analysis: The chi-square test, Analysis of Variance and Covariance, Correlational Analysis, Regression Analysis, Factor Analysis.

Unit III:

Methods of Data Collection:

Questionnaire: forms, principles of construction and their scope in educational research, administration of Questionnaires

Interview: types, characteristics and applicability, guidelines for conducting interviews.

Observation- Type and applicability.

Field data collection: physical features, coordinates.

Unit IV:

Report writing, referencing and citation:

Research and Academic Integrity: Copyright issues, Ethics in Research, Belmont Report and Plagiarism in research; Reproduction of published material – Plagiarism - Citation and acknowledgement - Reproducibility and accountability.

Suggested readings:

1. Amdeo, D and Golledge, RG (1975), An introduction to scientific reasoning in geography, new York, willey
2. Audi, Robert. Epistemology: A Contemporary Introduction to the Theory of Knowledge. London: Routledge, 2002.
3. Berg, Bruce L. Qualitative Research Methods for Social Sciences. Boston: Allyn and
4. Bacon, 2001.
5. Brent, Edward E. Computer Applications in the Social Sciences. Philadelphia: Temple University Press, 1990.
6. Bryant, Christopher G. A. and David Jary (eds). Giddens' theory of structuration: a critical appreciation. London: Routledge, 1991.
7. Bryman, Alan. Social Research Methods. New York: Oxford University Press, 2008.
8. Bunge, w (1963) theoretical geography, Lund studies in geography, series C, No.1 Stockholm, university of Stockholm.
9. Creswell, John W. Research Design: Qualitative, Quantitative and Mixed Methods

- Approaches. Thousand Oaks: Sage Publications, 2011.
10. Feyerabend, Paul. *Against Method: Outline of an Anarchist Theory of Knowledge*. London: New Left Books, 1975.
 11. Foucault, Michel. *Power/Knowledge: Selected Interviews and Other Writings, 1972-1977*. edited by Colin Gordon, New York: Vintage, 1980.
 12. Groves, Robert M, et al. *Survey Methodology*. New Jersey: Wiley, 2009.
 13. Guha, Ranajit (ed). *A Subaltern Studies Reader, 1986-1995*. New Delhi: Oxford University Press, 2000.
 14. Kuhn, Thomas. *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press, 1996.
 15. Lester, James D. and Jim D. Lester Jr. *Principles of Writing Research Papers*. New York: Longman, 2007.
 16. Lune, Howard, et al (eds). *Perspectives in Social Research Methods and Analysis*. Los Angeles: Sage, 2010.
 17. Marsh, David and Gerry Stoker (eds.). *Theory and Methods in Political Science*. 3rd Edition, London: Macmillan, 2010.
 18. Popper, Karl. *The Logic of Scientific Discovery*. New York: Basic Books, 1935/1959.
 19. Said, Edward W. *Orientalism*. New York: Vintage, 1979.
 20. Seale, Clive. *Social Research Methods: A Reader*. London: Routledge, 2004.
 21. Sen, Amartya. *On Ethics and Economics*. Oxford: Basil Blackwell, 1987.
 22. Sen, Amartya. "Rational Fools: A Critique of the Behavioral Foundations of Economic Theory," *Philosophy and Public Affairs*, 6(4), 1977, pp. 317-344.
 23. White, Hayden. *Metahistory: The Historical Imagination in Nineteenth-Century Europe*. Baltimore: The Johns Hopkins University Press, 1975.
 24. Hanson, S. 2004. Who are "we"? An important question for geography's future.
 25. Graham, E. 1997. Philosophies underlying human geography research. In Flowerdew, R. & Martin, D. (Eds.) *Methods in Human Geography*. Longman. p. 36-45. (E) *Annals of the Association of American Geographers* 94 (4):715-722. (T)

Course Title: Computer Applications

L	T	P	Cr	Marks
-	-	4	2	100

Course Code: GEO.702

Unit I

Fundamentals of computers: Parts of computers, Hardware, BIOS, Operating systems, Binary system, Logic gates and Boolean Algebra.

Application software: Spreadsheet applications, Word-processing applications, Presentation applications, Internet browsers, Reference Management, and Image processing applications.

Unit II:

Computer Language: Basic DOS commands, AutoHotKey scripting language, HTML and basic structure of a webpage, Designing websites.

World Wide Web: Origin and concepts, Latency and bandwidth, Searching the internet, Advanced web-search using Boolean logic, Cloud computing.

Unit III:

Computer Language: Basic DOS commands, AutoHotKey scripting language, HTML and basic structure of a webpage, Designing websites.

World Wide Web: Origin and concepts, Latency and bandwidth, Searching the internet, Advanced web-search using Boolean logic, Cloud computing.

Suggested readings:

1. Bhatt, Pramod Chandra P. An Introduction to Operating Systems: Concepts and Practice. Second edition, New Delhi: PHI Learning Pvt. Ltd., 2008.
2. Date, C. J. An Introduction to Database Systems. Massachusetts: Addison-Wesley Longman, 7th Edition, 2000.
3. David, Cyganski, John A. Orrand R.F. Vaz. Information Technology: Inside and Outside. New Jersey: Prentice Hall, 2000.
4. Douglas, Gretchen and Mark Connell. Fundamentals of MS Office 2007. Second edition, Dubuque: Kendall Hunt Publication Company, 2007.
5. Gookin, D. (2007). MS Word for Dummies. Wiley.
6. Harvey, G. (2007). MS Excel for Dummies. Wiley
7. Jamsa, Kris A. DOS: The Pocket Reference. Berkeley: Osborne McGraw-Hill, 1993.
8. Murdock, Everett E. DOS The Easy Way:A Complete Guide to Microsoft's MS DOS. H O T Press, Easy Way Downloadable Books, 1988.
9. Narang, Rajesh. Database Management System. New Delhi: PHI Learning Pvt. Ltd., 2006.
10. Rajaraman, V. Fundamentals of Computers. New Delhi: PHI Learning Pvt. Ltd., 2003. Sanders, Donald H. Computers Today. Singapore: McGraw Hill Publishing, 198.
11. Sinha, P.K., Computer Fundamentals, BPB Publications.
- 12.

Course Title: Geographical Information System-(T)

L	T	P	Cr	Marks
4	1	-	4	100

Course Code: GEO.703

Course Description:

The course introduces students to the fundamentals of GIS, GPS, data models, data sources, databases and Global Positioning Systems (GPS) and geospatial metadata. It prepares the candidate for the geospatial analysis.

Unit I (13 Lectures)

Concept and definition of GIS, History and development of GIS technology, applications of GIS in various sectors (case study examples); GIS database (types, structures) and data model; Data input: spatial and non-spatial; Scanning and Digitizing; Data import and export.

Unit II: (15 Lectures)

Geographic information and spatial data types (map, attributes, image data); Data processing systems (inputs and output devices); Data entry and preparations (inputs, editing and attributing); Geo-referencing; linking spatial and non-spatial data; Attribute handling. Functional Elements: Data Acquisition and Topology Creation; Data Management and Structure.

Unit III: (12 Lectures)

Spatial analysis: overlay, buffer and proximity, network analysis; Creation of digital elevation models (DEM): contours and spot heights; Determination of slope, aspect and hill shading; Data interpolation: point and line data; Output generation and layouts.

Unit IV: (16 Lectures)

Introduction to GPS, history of positioning system; Segments of GPS; GPS Applications. User interface with global positioning receivers; GNSS and types (NAVSTAR, GLONASS, GALILEO) introduction to DGPS, wide area augmentation system (WAAS); Collection of ground control points using hand held GPS receiver.

Suggested readings:

1. Bonham, Carter G.F. (1995): Information Systems for Geoscientists – Modelling with GIS. Pergamon, Oxford.
2. Burrough, P.A. and McDonnell, R. (1998): Principles of Geographic Information Systems. Oxford University Press, Oxford.
3. Chang, K.T. (2003): Introduction to Geographic Information Systems. Tata McGraw Hill Publications Company, New Delhi.
4. Chauniyal, D. D. (2004): Remote Sensing and Geographic Information Systems. (in Hindi). Sharda Pustak Bhawan, Allahabad.
5. Demers, M. N. (2000): Fundamentals of Geographic Information Systems. John Wiley and Sons, Singapore.

Additional readings:

1. ESRI (1993): Understanding GIS. Redlands, USA
2. Fraser Taylor, D.R. (1991): Geographic Information Systems. Pergamon Press, Oxford.
3. George, J. (2003): Fundamentals of Remote Sensing. Universities Press Private Ltd, Hyderabad.
4. Girard, M. C. and Girard, C. M. (2003): Processing of Remote Sensing Data. Oxford and IBH, New Delhi.
5. Glen, E. M. and Harold, C. S. (1993): GIS Data Conversion Handbook. Fort Collins, Colorado, GIS Word Inc.

6. Goodchild, M.F.; Park, B. O. and Steyaert, L. T. (eds.) (1993): Environmental Modelling with GIS. Oxford University Press, Oxford.
7. Guptill, S.C., and Morrison, J.L. (1995): Elements of Spatial Data Quality. Elsevier/ Pergamon, Oxford.
8. Heywood, I. (2003): An Introduction to Geographical Information Systems. 2nd edition, Pearson Publishing Company, Singapore.
9. Korte, G. M. (2002): The GIS Book. On Word Press: Thomson Learning, New York and Singapore.
10. Lo, C.P. and Yeung, A. K. W. (2002): Concepts and Techniques of Geographic Information Systems. Prentice Hall of India, New Delhi.
11. Longley, P. and Batty, M. (eds.) (1996): Spatial Analysis: Modelling in a GIS Environment. GeoInformation International, Cambridge.
12. Longley, P., Goodchild, M.F., Maguire, D. and Rhind, D. (1999): Geographic Information Systems. Principles, Techniques, Management, Applications. John Wiley and Sons, New York.
13. Maguirre, D. J.; Michael F. G. and David W. R. (1999): Geographical Information Systems: Principles and Application. Geo Information International, Vol.2, Longman Publication., New York.
14. Martin, D. (1996): Geographic Information Systems: Socioeconomic Implications. Routledge, London.
15. Michael F. G. and Karan K. K. (ed.) (1990): Introduction to GIS. NCGIA, Santa Barbara, California.
16. Ralston, B. A. (2002): Developing GIS Solutions with Map Objects and Visual Basic. OnWord Press: Thomson Learning, New York and Singapore.
17. Reddy, M. A. (2001): Textbook of Remote Sensing and Geographic Information Systems. B. S. Publications., Hyderabad.
18. Ripple, W. J. (ed.) (1989): Fundamentals of Geographic Information Systems: A Compendium. ASPRS/ ACSM, Falls Church.
19. Siddiqui, M.A. (2005): Introduction to Geographical Information Systems, Sharda Pustak Bhawan, Allahabad.
20. Star, J. and Estes, J. (1990): Geographic Information Systems – An Introduction. Prentice-Hall, Englewood Cliffs, New Jersey.

Course Title Geographical Information System – (P)

L	T	P	Cr	Marks
-	-	4	2	100

Course Code: GEO.704

Course Description:

The course provides a firm understanding of the conceptual and technical issues that affects the use of GIS and GPS. Through hands on exercise students will know about beauty of geographic/spatial data management.

Unit I

Practical Exercise: GIS Software: Introduction to Arc GIS 2. Georeferencing Maps/Images 3. Digitization of Raster Map: Point, Line and Polygon Features 4. Preparation of Attribute Tables, Editing and Joining Tables 5. Analyzing Attribute Data: Calculating Area, Perimeter, and Length.

Unit II:

Spatial Representation: Mapping Techniques 7. Spatial Representation: Symbolizing and Map Layouts 8. Basic Analysis in GIS: Buffering, Overlay and Query Building.

GPS Applications. User interface with global positioning receivers; Collection of ground control points using hand held GPS receiver; DGPS, wide area augmentation system (WAAS); transferring data from GPS receiver to PC.

Thematic Papers (Select only two)

Course Title: Population, development and environment

L	T	P	Cr	Marks
4	1	-	4	100

Course Code: GEO.705

Unit I

1. Concept: population, development and environment
2. Theories: Malthus, marx, neo-malthusian and cornucopian

Unit II:

3. Demographic transition: stages, form and transformation
4. Ageing: concept, measurement, global and Indian pattern, implications

Unit III:

5. Human development: component, measurement, distribution and poverty
6. Women and development: genders role, indicator of gender inequality, women and work participation, reproductive health

Unit IV:

7. Population and environment: climate change, global warming, food security
8. Measurement: Vital rate, life table and population projection

Suggested readings:

1. Newbold Bruce K. (2007) six billion plus: world's population in the 21st century, rowman and little field pub. USA
2. Zukerman Ben et al. (1996) human population and environmental crisis, jone & berlett, boston
3. Saraswati raju et al (1999) atlas of women and man in India, kali for women, New Delhi
4. Devaki jain (2005) women development and UN – A sixty years of quest for equality and justice, Indiana university press, USA
5. Domash M et al. (2001) Putting women in place, Gulliford press, New York.
6. Sialkind nail J (2006) encyclopedia of human development vol I,II,III sage new York
7. Ramakumar R (2006) technical demography, new age international New Delhi
8. Council for social development (2006) India social development report OUP new Delhi

Course Title: Regional analysis with special reference to India

L	T	P	Cr	Marks
4	1	-	4	100

Course Code: GEO.706

Unit I

1. Regions, regional system, regional disparities and regionalism
2. Theories of regional development: Myrdal-hirschman, dependency-world system & export base

Unit II:

3. Urban-regional theories: economic base theory, threshold theory, new urbanism
4. Methods and techniques of regionalization and regional analysis with reference to India

Unit III:

5. Regional resource analysis: resource region (reference to India); resource and livelihood; sustainability issue, conflicts in developmental goals, mega project and disadvantages communities

Unit IV:

6. Manufacturing belt and complexes of India; post-fordism, industrial regions- emerging patterns and regional disparities

Suggested readings:

1. Alonso W and Friedman (ed) (1974) Regional Policy; A reader Mass: MIT press
2. Berry, B.J.L and Marble D (ed) (1968) Spatial analysis Nj: Engelwood cliff
3. Guha Ramachandra and Madan TN (1994) Social Ecology New Delhi OUP
4. Isard W (1970) Location and Space Economy Philadelphia U. Penn
5. Kundu A (1977) Urbanization and Regional Development in India Concept New Delhi

Course Title: Earth and the Environment

L	T	P	Cr	Marks
4	1	-	4	100

Course Code: GEO.707

Unit I

Earth as a complex system: Components and their interrelations; Environment as resource field and sink; Environmental crisis: Causes and manifestations; Environmentalism and green movements; Major global environmental issues.

Unit II:

Environment and Development: Conventional and ecological economics; Production and consumption spiral; Impacts on ecosystems; Sustainable development: Is sustainability an impossibility theorem?

Unit III:

Environmental risk assessment: Perception, assessment and evaluation of environmental risks; Environmental impact assessment (EIA) and uncertainty; EIA practices around the world; EIA procedure in India; Adaptation to global environmental change

Unit IV:

Agenda 21; Globalisation and environment; Political economy of resource use and environmental management; Environmental management strategies at sub-national level: Integrated watershed and eco-region management; Management at local level: Municipal water supply management; Conservation and restoration of forest cover and organic farming at panchayat level.

Suggested readings:

1. Bailey, R.G. (2002) : Ecoregions : Design for Sustainability; New York: Springer Science & Business.
2. Bailey, R.G. and Ropes, L. (2007): Ecoregions : The Ecosystem in Geography of the Oceans and Continents; New York : Springer
3. Chiras, D.D. (2010): Environmental Science; London: Jones and Bartlett Publishers International
4. Common, M.S. and A Stage, S. (2005): Ecological Economics: An Introduction; Cambridge: Cambridge University Press.
5. Daly, H. E. ad Farley, J. (2004) :
6. Ecological Economics: Principles and Applications; Washington, D.C.: Island Press 6.
7. Dupont R., Baxter, T.E. and Theodore, L. (1998): Environmental Management: Problems and Solutions; Florida : CRC Press

Course Title: Urban Geography and Environment

L	T	P	Cr	Marks
4	1	-	4	100

Course Code: GEO.708

Unit I

Basic Concepts of Urban/Urbanization; Approaches to the study of Urban Geography; Urban Environment: Concept, Components and Levels of Analysis; Approaches to the study of Urban Environment.

Unit II:

Emerging Issues: Trends and Patterns of Urbanization in India: Post Independence Period; Functional Classification of Towns; Urban Problems and Environmental Degradation in India; Micro Climate of Cities; Urban Pollution (Air, Water and Noise) and Health Impacts. Rural-urban migration, Housing the urban poor, Poverty, power and politics.

Unit III:

Urban Environment: Urban environment problems; Concept of Urban Sustainability and Urban Environmental Conservation Strategies: Traffic and transport problems.

Unit IV:

Research Methods in Urban geography: Models for Internal Structure, Hierarchy and Spacing of Cities; Urban Sprawl; Urban Poverty and Slums; Use of Remote Sensing Data for Urban Land uses and Change Detection; GPS and GIS for Urban Mapping; Socio-economic and Environmental Surveys for Urban Themes.

Suggested readings:

1. Carter, H., 1972. The Study of Urban Geography, Edward Arnold, London.
2. Choley, R.J.O. and Haggett, P. 1966. Models in Geography, Methuen, London.
3. Gibbs, J.P. 1961, Urban Research Methods, Princeton, New Jersey.
4. Nangia, S., 1976. Delhi Metropolitan Region: A Study in Settlement Geography, Rajesh Publications.
5. Hall, P., 1992. Urban and Regional Planning, Routledge, London.
6. Burgess, R., Marisa C., and Thed K. , 1977. The Challenge of Sustainable Cities, Zed Books, New Jersey.
7. Canter, L.W., 1996. Environment Impact Assessment , Mc Graw Hill Inc. New York.
8. Gilbert, and Joseph G., Cities, Poverty and Development-Urbanization in the 3rd World, Oxford University Press, Oxford.
9. Knox, P., 1994. Urban Social Geography- An Introduction, Longman, U.K.
10. Goudie, A., 1993. The Human Impact on Natural Environment, Blackwell, USA.

Course Title: Land Degradation and Desertification

L	T	P	Cr	Marks
4	1	-	4	100

Course Code: GEO.708

Unit I

Types and causes of land degradation and desertification: Definition, and concept, Clear cutting, Deforestation, Agricultural depletion of soil nutrients through poor farming practices, Overstocking and overgrazing, Land pollution including industrial waste, Mining and quarrying, Climate change as cause and result of degradation of dryland areas.

Unit II:

Processes and consequences of degradation: Impacts of soil degradation on the landscape and the built environment both temporally and spatially: The consequences of loss of topsoil, acidification, water logging, salinization, compaction, reduced soil fertility, the consequences for productivity; famine, starvation, migration and economic loss.

Unit III:

Land degradation distribution patterns in India: Land, Population and environment in India, Status of degradation in India, Economic consequences of land degradation, Impact of land degradation on people.

Unit IV:

Methods of monitoring land degradation: Methods of monitoring desertification/ degraded land and recognizing its spread including the use of remote sensing, Interpretation of Satellite imagery, LULC classification, change detection, Ground verification, Soil erosion intensity mapping, NDVI, Land capability classification.

Unit V:

Managing land degradation and desertification: Mitigation strategies at different scales include: short term including the use of appropriate/intermediate technology, Long term planning to include irrigation systems and land use change, Mitigation strategies for soil degradation at different scales such as: Improving monitoring, improving information and communication, improving technology, improving practices, Political solutions; incentives and investment, Institutions and programmes to combat degradation.

Suggested readings:

1. Barrow, C.J. Land Degradation: Development and Breakdown of Terrestrial Environments. Cambridge: Cambridge University Press, 1991.
2. Beinroth, F.H, H Eswaran, P.F. Reich and E Van Den Berg. "Land Related Stresses in Agroecosystems." in S.M. Virmani, J.C. Katyal, H. Eswaran, and I.P. Abrol (eds), Stressed Ecosystems and Sustainable Agriculture. New Delhi: Oxford and Ibh, 1994.
3. Blaikie, P. and H. Brookfield. Land Degradation and Society. London: Methuen, 1987.
4. Crosson, P.R. "The On-Farm Economic Costs of Erosion." in R. Lal, W.E.H. Blum, C. Valentin and B.A. Stewart (eds). Methods for Assessment of Land Degradation. Boca Raton: Crc. 1997.
5. Darkoh, M.K. "The Deterioration of the Environment in Africa's Drylands and River Basins." Desertification Control Bulletin, 24, 1995: 35-41.
6. Dregne, H.E. "Erosion and Soil Productivity in Africa." Journal of Soil and Water Conservation, 45, 1990: 431-436.
7. Dregne, H.E. (ed). Degradation and Restoration of Arid Lands. Lubbock: Texas Technical University, 1992.
8. Dregne, H.E. and N.T. Chou. "Global Desertification Dimensions and Costs." in H.E. Dregne (ed). Degradation and Restoration of Arid Lands. Lubbock: Texas Technical University. 1994.
9. Dumanski, J., H. Eswaran and M. Latham. "A Proposal for An International Framework For Evaluating Sustainable Land Management." in J. Dumanski, E. Pushparajah, M. Latham, And R.

- Myers (eds). Evaluation For Sustainable Land Management In The Developing World, Ibsram Proceedings No. 12, Vol. 2, 1992: 25–45. Bangkok: Ibsram.
10. Eriksson, J., I Hakansson, and B Danfors. The Effect of Soil Compaction on Soil Structure And Crop Yields. Bulletin 354. Uppsala: Swedish Institute of Agricultural Engineering, 1974.
 11. Eswaran, H. "Soil Resilience and Sustainable Land Management in the Context of Agenda 21." in D.J Greenland and I. Szabolcs (eds), Soil Resilience and Sustainable Land Use. Wallingford: Cabi, 1993: 21–32.
 12. Eswaran, H. and J. Dumanski. "Land Degradation And Sustainable Agriculture: A Global Perspective." in L.S. Bhushan, I.P. Abrol, And M.S. Rama Mohan Rao (eds), Proceedings of the 8th International Soil Conservation Organization (Isco) Conference, Vol. 1, Dehra Dunn: Indian Association of Soil And Water Conservationists, 1994: 208–226.
 13. Eswaran, H., P.F. Reich and F.H. Beinroth. "Global Distribution Of Soils With Acidity." in A.Z. Moniz, A.M.C. Furlani, R.E. Schaffert, N.K. Fageria, C.A. Rosolem and H. Cantarella (eds), Plant-Soil Interactions At Low Ph: Sustainable Agriculture And Forestry Production, Proceedings Of The 4th International Symposium On Plant-Soil Interactions At Low Ph, Belo Horizonte, Minas Gerais, Brazil, 1997: 159–164.
 14. Eswaran, H., R. Almaraz, E. Van Den Berg and P.F. Reich. "An Assessment of the Soil Resources of Africa In Relation To Productivity." *Geoderma*, 77, 1997: 1–18.
 15. Eswaran, H. and P.F. Reich. "Desertification: A Global Assessment and Risks to Sustainability." Proceedings of the 16th International Congress of Soil Science, Montpellier, France. 1998.
 16. Greenland, D.J., G. Bowen, H. Eswaran, R. Rhoades and C. Valentin. Soil, Water, and Nutrient Management Research: A New Agenda. Ibsram Position Paper. Bangkok: Ibsram. 1994.
 17. Hartemink, A.E. Land Fertility Decline under Sisal Cultivation in Tanzania. Isric Technical Paper 28. Wageningen: Isric, 1995.
 18. Johnson, D.L. and L.A. Lewis. Land Degradation: Creation and Destruction. Oxford: Blackwell, 1995.
 19. Lal, R. "Tillage Effects on Soil Degradation, Soil Resilience, Soil Quality and Sustainability." *Soil Tillage Research*, 27, 1994: 1–8.
 20. Lal, R. "Erosion–Crop Productivity Relationships For Soils Of Africa." *Soil Science Society of America Journal*, 59, 1995: 661–667.
 21. Lal, R. "Axle Load and Tillage Effects on Soil Degradation and Rehabilitation in Western Nigeria. I. Soil Physical and Hydrological Properties." *Land Degradation Review*, 7, 1996: 19–45.
 22. Lal, R. "Soil Erosion Impact on Agronomic Productivity and Environment Quality." *Critical Reviews in Plant Sciences*, 17, 1998: 319–464.
 23. Lal, R. and B.A. Stewart (eds). Land Degradation. *Advances in Soil Science*. Vol. 11, New York: Springer, 1994.
 24. Lal, R., W.E.H. Blum, C. Valentin and B.A. Stewart (eds). *Methods for Assessment of Land Degradation*. Boca Raton: Crc, 1997.
 25. Mabbutt, J.A. "Degradation of the Australian Drylands: A Historical Approach." in H.E. Dregne (ed), *Degradation and Restoration of Arid Lands*. Lubbock: Texas Technical University. 1992: 27–98.
 26. Maingnet, M. (ed). *Desertification: Natural Background and Human Mismanagement*. Berlin: Springer, 1994.
 27. Mbagwu, J.S., R. Lal and T.W. Scott. "Effects of Desurfacing of Alfisols and Ultisols in Southern Nigeria. I. Crop Performance." *Soil Science Society of America Journal*, 48, 1984: 828–833.
 28. Mermut, A.R and H. Eswaran. "Opportunities for Soil Science in a Milieu of Reduced Funds." *Canadian Journal of Soil Science*, 77, 1997: 1–7.
 29. Middleton, N. and D.S.G. Thomas. *World Atlas of Desertification*. London: Edward Arnold. 1997.

30. Oldeman, L.R. "The Global Extent of Land Degradation." in D.J. Greenland and I. Szabolcs (eds), *Land Resilience And Sustainable Land Use*, Wallingford: Cabi. 1994: 99–118.
31. Oldeman, L.R., R.T.A. Hakkeling and W.G. Sombroek. *World Map of the Status of Human-Induced Soil Degradation: An Explanatory Note*. Wageningen: Isric, 1992.
32. Reich, P.F., S.T. Numbem, R.A. Almaraz and H. Eswaran. "Land Resource Stresses and Desertification in Africa." in Bridges, E.M., I.D. Hannam, L.R. Oldeman, F.W.T. Pening de Vries, S.J. Scherr, and S. Sompatpanit (eds.). *Responses to Land Degradation. Proc. 2nd. International Conference on Land Degradation and Desertification*, New Delhi: Oxford University Press, 2001.
33. Sajjapongse, A. *Asialand: Management of Sloping Lands Network: An Overview of Phase 3*. Network Document No. 23, Bangkok: Ibsram, 1998.
34. Schumacher, T.E., M.J. Lindstrom, D.L. Mokma and W.W. Nelson. "Corn Yields: Erosion Relationships of Representative Loess and Till Soils in the North Central United States." *Journal of Soil and Water Conservation*, 49, 1994: 77–81.
35. Stocking, M. "The Cost of Soil Erosion in Zimbabwe in Terms of the Loss of Three Major Nutrients." Consultant's Working Paper No. 3. Soil Conservation Programme. Rome: FAO Land and Water Division, 1986.
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