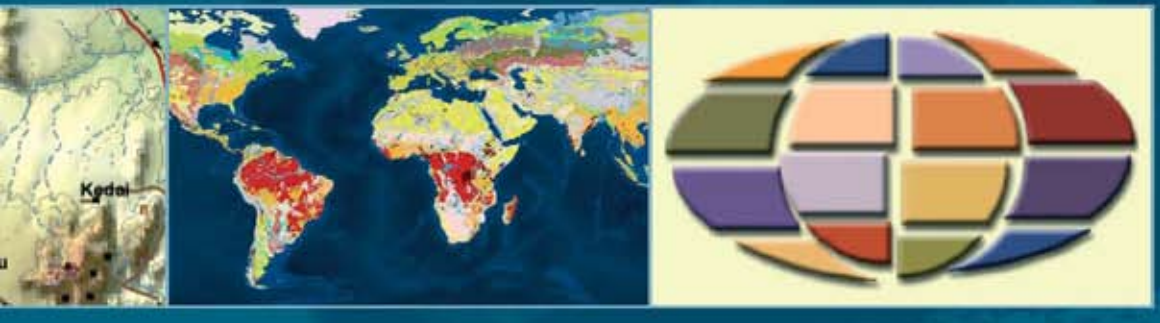
ISSN 1684-8241

11

ENVIRONMENT AND NATURAL RESOURCES SERIES

[GEO-SPATIAL DATA AND INFORMATION] ENVIRONMENTAL MANAGEMENT ASSESSMENT AND MONITORING GLOBAL ENVIRONMENTAL CHANGE

Mapping biophysical factors that influence agricultural production and rural vulnerability



POVERTY MAPPING
GEOGRAPHY OF POVERTY
GEOGRAFÍA DE LA POBREZA
GÉOGRAPHIE DE LA PAUVRETÉ

IIASA

FAO
FIAT PANIS

11

ENVIRONMENT AND NATURAL RESOURCES SERIES

[GEO-SPATIAL DATA AND INFORMATION] ENVIRONMENTAL MANAGEMENT ASSESSMENT AND MONITORING GLOBAL ENVIRONMENTAL CHANGE

Mapping biophysical factors that influence agricultural production and rural vulnerability

Harrij van Velthuizen
Barbara Huddleston
Günther Fischer
Mirella Salvatore
Ergin Ataman
Freddy O. Nachtergaele
Marina Zanetti
Mario Bloise

and FAO GIS specialists:
Antonello Antonicelli
Judith Bel
Anna De Liddo
Paola De Salvo
Gianluca Franceschini

Food and Agriculture Organization of the United Nations and
International Institute for Applied Systems Analysis, Rome 2007

Ideas contained in this document are solely those of the authors and do not necessarily represent the views of FAO or IIASA. The conclusions given in this report are considered appropriate at the time of its preparation. They may be modified in the light of further knowledge gained at subsequent stages of the project.

ISBN 978-92-5-105689-9

FOREWORD

GIS technology provides the tools for integration of environmental and socio-economic geospatial data through space and time, allowing possibilities for assessment, monitoring, and change detection in both human and natural systems.

This publication, jointly prepared by FAO and IIASA, explains the GIS-based methodologies used for constructing a set of databases relating to biophysical factors that influence agricultural production and rural vulnerability and shows the distribution of rural populations in various agro-ecological environments. The databases themselves have been released by FAO as part of a larger collection – the *Food Insecurity, Poverty and Environment Global GIS Database (FGGD)* – which is available as a digital atlas on two DVDs, with an accompanying hardcopy version.

We are confident that continued application of such GIS-based analysis techniques will not only deepen our understanding of the links between poverty and the environment, but will also prove to be of immediate use to those concerned with improving living conditions in vulnerable environments in a sustainable manner.

FAO is grateful to the Government of Norway for the encouragement and funding it has provided for this work.

Jeffrey B. Tschirley
Chief, Climate Change and Bioenergy Division, FAO

ABSTRACT

This monograph is part of a series of reports that explain how techniques of spatial analysis can be used to investigate poverty and environment links worldwide. It combines rural population distribution data contained in the global rural population database for the year 2000 (FAO, 2005) with methods and results of the *Global agro-ecological assessment for agriculture in the 21st Century* (Fischer *et al.*, 2002), in order to estimate the distribution of the world's rural population by agricultural suitability class, land use category and type of farming system. Refinements in GIS databases and analysis techniques have been developed collaboratively by FAO and IIASA in the project *Improving Methods for Poverty and Food Insecurity Mapping and its Use at Country Level*, which was jointly implemented by FAO, UNEP/GRID-Arendal and CGIAR centers and funded by the Government of Norway. The report considers the constraints imposed by environmental conditions at different levels of human input, evaluates agricultural production potential of the world's land area at a resolution of 5 arc-minutes (about 85 square kilometre at the equator), and reports on rural habitation in relation to agricultural production potential, land use patterns and farming systems. Other related reports are: *A geospatial framework for the analysis of poverty and environment links, Mapping global urban and rural population distributions and Food Insecurity, Poverty and Environment Global GIS Database (FGGD) and Digital Atlas for the Year 2000*.

Mapping biophysical factors that influence agricultural production and rural vulnerability
by Harrij van Velthuizen, Barbara Huddleston, Günther Fischer, Mirella Salvatore, Ergin Ataman, Freddy O. Nachtergaele, Marina Zanetti and Mario Bloise

96 pages, 5 boxes, 3 figures, 28 tables, 57 maps.

Environment and Natural Resources Series No. 11, FAO, Rome 2007

Keywords:
Global agro-ecological zones, GAEZ, AEZ, productivity potential, suitability, rural population, GIS, land cover, farming system, environmental constraint, poverty mapping

This series replaces the following:
Environment and Energy Series
Remote Sensing Centre Series
Agrometeorology Working Paper

A list of documents published in the above series and other information can be found at the Web site: **www.fao.org/sd/enpub1_en.htm**

ACKNOWLEDGEMENTS

The authors have benefited from the continuous technical advice and counsel of many colleagues in FAO, IIASA, IFPRI and other organizations. Special thanks go to the following individuals for their technical advice, assistance for improving the document and/or providing maps and data: Jelle Bruinsma, FAO/ESDG; John Dixon, CIMMYT; Jippe Hoogeveen, FAO/AGLW; Tim Robinson, FAO/AGAL; Kate Sebastian, IFPRI; Jan Slingenbergh, FAO/AGAH.

About the authors

The authors are affiliated with the institutions below:
Harrij van Velthuizen, International Institute for Applied Systems Analysis (IIASA)
Barbara Huddleston, Environment and Natural Resources Service (SDRN), FAO
Günther Fischer, International Institute for Applied Systems Analysis (IIASA)
Mirella Salvatore, Environment and Natural Resources Service (SDRN), FAO
Ergin Ataman, Environment and Natural Resources Service (SDRN), FAO
Freddy O. Nachtergaele, Land and Plant Nutrition Management Service (AGLL), FAO
Marina Zanetti, Environment and Natural Resources Service (SDRN), FAO
Mario Bloise, Environment and Natural Resources Service (SDRN), FAO

CONTENTS

LIST OF BOXES, FIGURES, TABLES AND MAPS

BOXES

FIGURES

TABLES

MAPS

ACRONYMS

AEZ	Agro-Ecological Zones
AGAH	Animal Health Service
AGAL	Livestock, Information, Sector Analysis and Policy Branch
AGLW	Water Resources, Development and Management Service
AGPC	Crop and Grassland Service
CGIAR	Consultive Group on International Agricultural Research
CRU	Climate Research Unit of the University of East Anglia
CSI	Crop suitability index
CV	Coefficient of variation
ESDG	Global Perspective Studies Unit
FAO	Food and Agriculture Organization
FS	Farming systems
GAEZ	Global Agro-Ecological Zones
GIS	Geographic Information System
GLCC	Global Land Cover Classification
GRID-Arendal	Global Resource Information Database (Arendal, Norway)
GTOPO30	Global 30 arc-second Digital Elevation Model
IFPRI	International Food Policy Research Institute
IIASA	International Institute for Applied Systems Analysis
IUCN	International Union for the Conservation of Nature and Natural Resources
LGP	Length of growing period
LUTs	Land Utilization Types
MS	moderately suitable
mS	marginally suitable
NOAA	National Oceanic and Atmospheric Administration
NPP	Net Primary Productivity
ORNL	Oak Ridge National Laboratory
PSI	Pasture suitability index
S	suitable
SD	Standard deviation
SDRN	Environmental and Natural Resource
UN	United Nations
UNEP	United Nation Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
VS	very suitable
WCMC	World Conservation Monitoring Centre