



# Sahel

atlas of changing  
landscapes

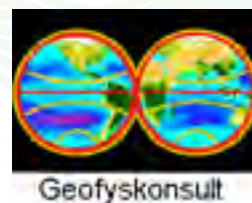
tracing trends and variations in vegetation cover and soil condition



UNEP

# Sahel atlas of changing landscapes

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ISBN: 978-92-807-3300-6

UNEP Job Number: DEW/1611/NA

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#### **This report should be cited as:**

UNEP (2012). Sahel Atlas of Changing Landscapes: Tracing trends and variations in vegetation cover and soil condition. United Nations Environment Programme, Nairobi.

This Atlas is a companion to the report:

UNEP (2012). Land Health Surveillance: An Evidence-Based Approach to Land Ecosystem Management. Illustrated with a Case Study in the West Africa Sahel. Summary for Decision Makers. United Nations Environment Programme, Nairobi.

#### **Acknowledgements**

This document is a product of UNEP's project "An Ecosystem Approach to Restoring West African Drylands and Improving Rural Livelihoods through Agroforestry-based Land Management Interventions".

We are grateful to the Governments of Burkina Faso, Mauritania, Niger and Senegal for their participation in the project, and especially to the Government of Mali's Institut d'Economie Rural (IER) for hosting the project operations in Mali. We also thank the Directorate for Nature Conservation (DNCN) in Segou for field support. We gratefully acknowledge field and laboratory assistance from staff of IER, especially Oumar Doumbia, Lassana Dioni and Mamadou Doumbia; and regional coordination support from Bocary Kaya and Serigne Kandji from the World Agroforestry Centre. We are very grateful to the Government of Norway for providing the principal funding for this project.

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Printed and bound in Malta by Progress Press Ltd, Malta Progress Press Ltd, P.O. Box 328, 341 St. Paul Street, Cmr 01 Valletta, Malta

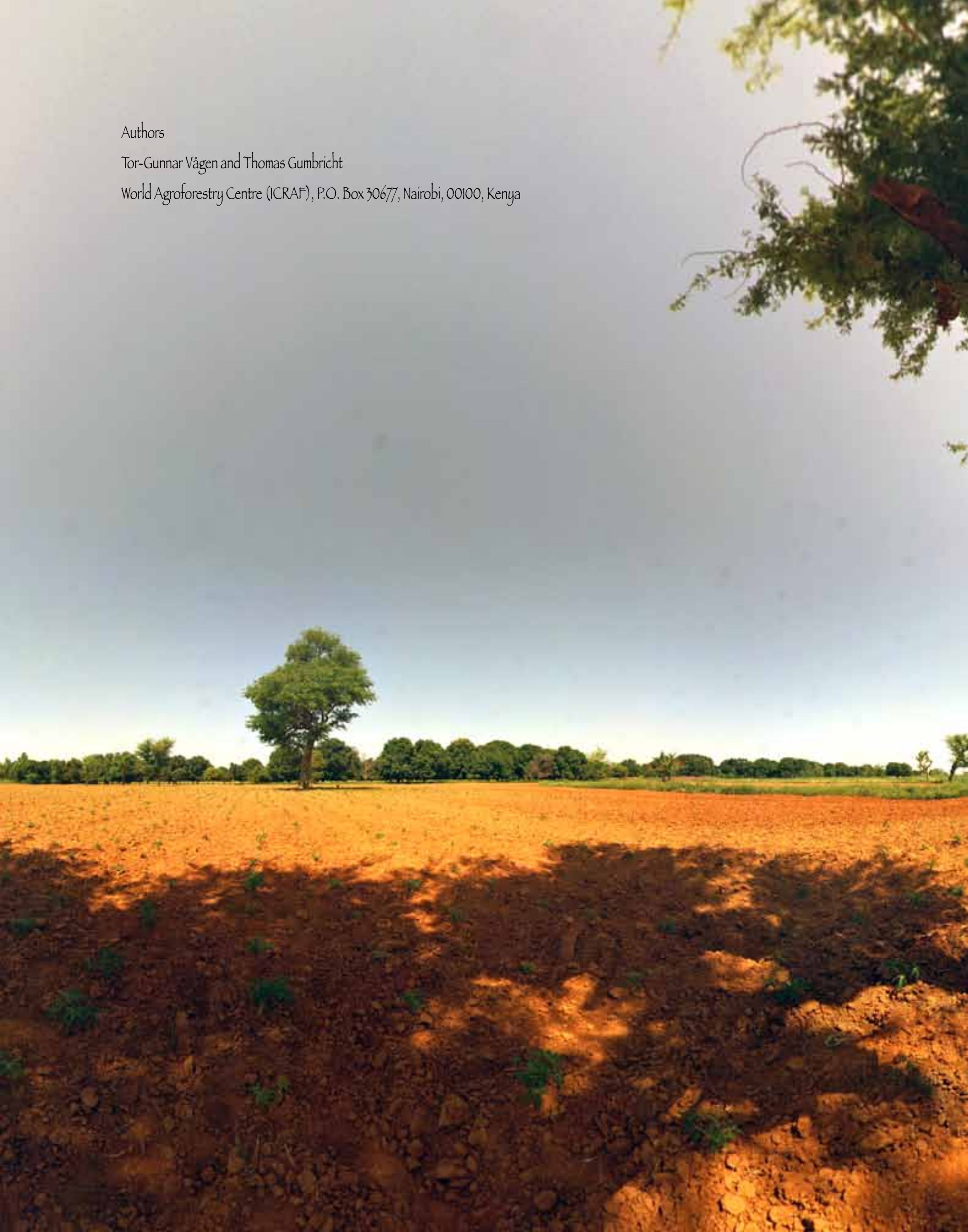
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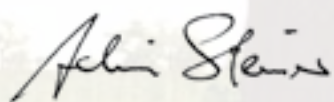
Developing countries, especially dryland countries in sub-Saharan Africa, depend strongly on ecosystem services generated by natural resources. However, as documented in UNEP's Global Environment Outlook (GEO-5), unprecedented land use changes resulting from the needs of a burgeoning population, economic development and global markets, and exacerbated by land governance issues locally, continue to cause depletion and degradation on an unprecedented scale. For example there is evidence of decline in the capacity of forest and dryland ecosystems to provide services on a regional basis. There are signs of larger scale feedbacks on regional climate change from desertification and deforestation. Competing demands for food, feed, fuel, fibre and raw materials will further intensify pressures on land over the next several decades.

The billion poorest people in the world are disproportionately affected by land degradation because they mostly live in rural areas and are directly dependent on forests, croplands and rangelands for their livelihoods. Agriculture and the land resource base form the foundation for economic development of poorer countries, especially in the Sahel. Land degradation leaves populations vulnerable and decreases adaptive capacity to global change, especially climate change.

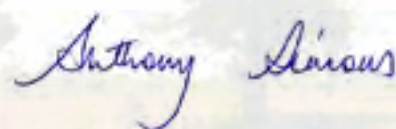
The Rio+20 outcome document The Future We Want called for urgent action "to reverse land degradation and to strive to achieve a land degradation neutral world in the context of sustainable development." Strategies for improved land management, such as those included in a Green Economy, emphasize the need for incorporating monitoring, valuation and protection of natural resources into economic decision making.

This Atlas illustrates the potential for harnessing new science and technology to provide accurate and cost-effective methods for assessing and monitoring land health at different scales. Better location specific information on land resource status and trends will improve evidence-based targeting of interventions and promote more rigorous impact assessment.

The Atlas shows how advances in remote sensing from satellites in space to spectrometers on the laboratory bench and systematic field survey can be integrated to provide a basis for operationalizing evidence-based land management. Finally, this report provides rich and valuable insights into the climate and vegetation dynamics of the Sahel, putting recent drought and land use changes in the context of longer-term historic changes.



**Achim Steiner**  
United Nations Under-Secretary-General and Executive Director  
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# Preface

Land degradation is widely recognized as an important global environmental problem threatening human development, especially in the world's poorest countries, not least the Sahelian region in West Africa. However, policy action is being hampered by the fact that land degradation remains a controversial and poorly quantified problem in the Sahel. There has been insufficient investment in the consistent application of science-based methods for assessing and monitoring land degradation. Without such efforts it will be difficult to guide policy and learn from past actions.

Land health surveillance is a scientific approach to land health assessment that is closely modelled on evidence-based approaches used in the public health sector – where surveillance is the main mechanism for determining public health policy and practice. The surveillance framework addresses the critical need to generate relevant and specific information on land health and degradation as an integral part of national planning processes aimed at better ecosystem and climate management and improved human well-being. Land health surveillance tells us where land problems exist; whom they affect; where programmatic and prevention activities should be directed; and how well they are working.

The Atlas provides a pictorial overview of the application of land health surveillance science in the Sahel at multiple scales from regional to local levels. It illustrates unprecedented advances in earth observation using remote sensing from space, in the field and on the laboratory bench, combined with geographical information systems, and hierarchical statistical methods. The landscapes, climate, vegetation and trends in vegetation and soil health in the Sahel are described.

The Atlas gives a detailed account of the historic, current and projected climate systems that principally determine Sahelian vegetation growth. Coarse resolution remote sensing and rainfall data are presented to provide a regional overview of recent time in trends vegetation growth over the West Africa Sahel. More detailed analyses of the indicative trends of vegetation degradation (land degradation hot spots) or improvement (greening-up) are investigated further using moderate resolution satellite data for a number of locations across the region. The results demonstrate the complexity of spatial and temporal landscape dynamics at local scales and the challenges they present for interpreting trends from broad scale remote sensing data.

Finally a ground-based surveillance scheme, including novel low-cost soil analytical methods, is illustrated with an application in Segou District in Mali. These results illustrate the feasibility of integrating consistent ground-based data with remote sensing in an efficient manner.

Consistent application of the new land health surveillance methods across the region would provide a sound basis for the future management of the Sahelian land resource base. There is need for a major capacity strengthening initiative to harness the new science approaches and tools to provide evidence-informed decision making as part of everyday policy and practice.

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