Climate Change and Agriculture IMPACTS, ADAPTATION IMPACTS, ADAPTATION By Anita Wreford, Dominic Moran and Neil Adger

GREENT AGRICULTURAL MARGINAL AL MARGINAL ABATEME AGRICULTURAL

ARGI

MENT

OST CUR

DLICY GR

NHOUSE GASES IN

GREENHOUSE GASES AGRICULTURAL POLICY MARGINAL ABATEMENT COST CURVES GREEN GREENHOUSE GASES MARGINAL ABATEMENT COST CURVES AGRICULTURAL POLICY MARGINAL ABATEMENT ON AGRICULTURAL POLICY MARGINAL ABATEMENT COST CURVES GREENHOUSE GASES AGRICULTURAL POLICY MARGINAL ABATEMENT COST MARGINAL ABATEMENT COST CURVES AGRICULTURAL POLICY GREENHOUSE GASES MARGINAL ABA MARGINAL ABATEMENT COST CURVES GREENHOUSE GASES AGRICULTURAL POLICY MARGINAL ABATEMENT COST CURVES GREENHOUSE AGRICULTURAL POLICY GREENHOUSE GASES MARGINAL ABATEMENT COST CURVES AGRICULTURAL GREENHOUSE GASES AGRICULTURAL POLICY MARGINAL ABATEMENT COST CURVES GREENHOUSE GREENHOUSE GASES MARGINAL ABATEMENT COST CURVES GREENHOUSE GASES AGRICULTURAL POLICY MARGIN GREENHOUSE GASES MARGINAL ABATEMENT COST CURVES AGRICULTURAL POLICY GREENHOUSE G GREENHOUSE GASES MARGINAL ABATEMENT COST CURVES AGRICULTURAL POLICY GREENHOUSE G GRICULTURAL POLICY MARGINAL ABATEMENT COST CURVES AGRICULTURAL POLICY GREENHOUSE G GRICULTURAL POLICY MARGINAL ABATEMENT COST CURVES AGRICULTURAL POLICY GREENHOUSE G GRICULTURAL POLICY MARGINAL ABATEMENT COST CURVES AGRICULTURAL POLICY GREENHOUSE G GRICULTURAL POLICY MARGINAL ABATEMENT COST CURVES AGRICULTURAL POLICY GREENHOUSE G GRICULTURAL POLICY MARGINAL ABATEMENT COST CURVES

AGRICULTURAL POLICY MARGINAL ABATEMENT COST CURVES GREENHOUS

MARGINAL ABATEMENT COST CURVES AGRICULTURAL POLICY GREENHOUSE GASES MARGINAL ABA MARGINAL ABATEMENT COST CURVES GREENHOUSE GASES AGRICULTURAL POLICY MARGINAL ABATEMENT COST CURVES GREENHOUSE AGRICULTURAL POLICY GREENHOUSE GASES MARGINAL ABATEMENT COST CURVES AGRICULTURAL GREENHOUSE GASES AGRICULTURAL POLICY MARGINAL ABATEMENT COST CURVES GREENHOUSE GASES AGRICULTURAL POLICY MARGIN HOUSE GASES MARGINAL ABATEMENT COST CURVES AGRICULTURAL POLICY GREENHOUSE HOUSE GASES MARGINAL ABATEMENT COST CURVES AGRICULTURAL POLICY GREENHOUSE HOUSE GASES MARGINAL ABATEMENT COST CURVES AGRICULTURAL POLICY GREENHOUSE HOUSE GASES MARGINAL ABATEMENT COST CURVES AGRICULTURAL POLICY GREENHOUSE HOUSE GASES MARGINAL ABATEMENT COST CURVES AGRICULTURAL POLICY GREENHOUSE HOUSE GASES MARGINAL ABATEMENT COST CURVES AGRICULTURAL POLICY GREENHOUSE HOUSE GASES MARGINAL ABATEMENT COST CURVES AGRICULTURAL POLICY GREENHOUSE HOUSE GASES AGRICULTURAL POLICY GREENHOUSE GASES AGRICULTURAL POLICY GREENHOUSE HOUSE GASES MARGINAL ABATEMENT COST CURVES AGRICULTURAL POLICY GREENHOUSE HOUSE GASES AGRICULTURAL POLICY GREENHOUSE GASES AGRICULTURAL POLICY GREENHOUSE HOUSE GASES AGRICULTURAL POLICY GREENHOUSE GASES AGRICULTURAL POLICY GREENHOUSE HOUSE GASES AGRICULTURAL POLICY GREENHOUSE GASES AGRICULTURAL POLICY GREENHOUSE HOUSE GASES AGRICULTURAL POLICY GREENHOUSE GASES AGRICULTURAL POLICY GREENHOUSE HOUSE GASES AGRICULTURAL POLICY GREENHOUSE GASES AGRICULTURAL POLICY GREENHOUSE HOUSE GASES AGRICULTURAL POLICY GREENHOUSE GASES AGRICULTURAL POLICY GREENHOUSE HOUSE GASES AGRICULTURAL POLICY GREENHOUSE GASES AGRICULTURAL POLICY GREENHOUSE HOUSE GASES AGRICULTURAL POLICY GREENHOUSE GASES AGRICULTURAL POLICY GREENHOUSE HOUSE GASES AGRICULTURAL POLICY GREENHOUSE GASES AGRICULTURAL POLICY GREENHOUSE HOUSE GASES AGRICULTURAL POLICY GREENHOUSE GAGREANHOUSE GASES A

POLICY MARGINAL ABATEMENT COST CURVES GREEN





Climate Change and Agriculture

IMPACTS, ADAPTATION AND MITIGATION

Anita Wreford, Dominic Moran and Neil Adger

372/4390 Leibniz Universität Hannover Institut für Meteorologie und Klimatologie

Herrenhäuser Str. 2 · 30419 Hannover



• an opping their boxes boxes provide a new least ling indexisit, provide the builder or commercial are us on a batterin of this material is been a battering in the second area.

Table of Contents

Glossary of Terms and Abbrevations	9
Executive Summary	
Chapter 1 Introduction	
Chapter 2 Climate change projections	21
IPCC projections	21
Primary effects and interactions	
Pastures and livestock production Industrial crops	
Chanter 3	
Impacts and sensitivities in agriculture	
Uncertainty issues	
Estimates of global production, trade and food security	
Impacts on food prices	
Emerging case for immediate action	
Chapter 4 Adaptation	
The scope of adaptation	
Adaptation in agriculture observed	64
Estimating the costs and benefits of adaptation	68
The role for public policy in adaptation	
Policy instruments for adaptation	
Chapter 5 Mitigation	
Agriculture as a source of emissions	
Agricultural emissions inventory	
The economics of mitigation	

CLIMATE CHANGE AND AGRICULTURE: IMPACTS, ADAPTATION AND MITIGATION © OECD 2010

$\mathbf{6}$ – TABLE OF CONTENTS

Cost effectiveness and efficient mitigation	82
Mitigation measures	84
MACC exercises	85
Carbon budgeting in UK agriculture	
Policy instruments for mitigation	90
Chapter 6	
Integrating mitigation and adaptation	93
Chapter 7	
Relevant climate research in other agencies	97
Reference entrate rescur en ni otrier ageneres initiation initiation initiation	
Chapter 8	
Future research needs	101
Valuation of climate change impact scenarios	101
The promotion of adaptation frameworks (based on cost-benefit analysis)	102
The development of marginal abatement cost modelling to develop emissions	
hudgets	102
Research on the application of alternative voluntary and market-based instruments	102
in relation to food and farming	103
Pahavioura	104
Dellaviours	104
Annex A	105
Other international institutions' activities	105
Country/accience] activity	105
A so demis institutions	109
	114
n in the second s	117
BIDHography	117

Tables

Summary of selected conclusions from IPCC for food and fibre	25
Impacts on grasslands of incremental temperature change	34
Number of people in the 2050s with an increase in water stress	
and with a decrease in water stress, for selected regions	43
Proposed framework for agricultural metrics for impact assessment	51
Examples of adaptation options by timing and by responsibility	62
Types and examples of adaptation options at different levels	
in agriculture	63
Comparison of agricultural insurance systems for EU Mediterranean	
countries	75
Defra shadow price of carbon to 2040	83
Mitigation measures affecting adaptation in agricultural systems	96
	Summary of selected conclusions from IPCC for food and fibre Impacts on grasslands of incremental temperature change Number of people in the 2050s with an increase in water stress and with a decrease in water stress, for selected regions Proposed framework for agricultural metrics for impact assessment Examples of adaptation options by timing and by responsibility Types and examples of adaptation options at different levels in agriculture Comparison of agricultural insurance systems for EU Mediterranean countries Defra shadow price of carbon to 2040 Mitigation measures affecting adaptation in agricultural systems

CLIMATE CHANGE AND AGRICULTURE: IMPACTS, ADAPTATION AND MITIGATION © OECD 2010

Figures

IPCC Fourth Assessment Report projections of global mean	
temperature for six representative emissions scenarios and a	
range of climate sensitivities	22
Simulated crop yield changes by the 2080s relative to the period	
1961-90 according to a high emission scenario (IPCC A2) and two	
different climate models	31
The potential increases in yield exhibited by wheat, rice, maize	
and soybean under elevated levels of CO ₂	41
Cereal prices (% of baseline) versus global mean temperature change	
for major modelling studies	47
Additional millions of people at risk from hunger (incomes less than	
price of necessary purchase of staple foods), compared to no climate	
change reference case, under seven climate change and socio-economic	
scenarios	48
Costs and benefits of adaptation	69
Diagram of collaborative institutional arrangements for environmental	
action in the context of climate change	77
Notional marginal abatement cost schedule for CO ₂ e	84
An illustrative MACC and its relationship to a carbon budget	87
Illustrative marginal abatement cost curve for UK agriculture	89
	 IPCC Fourth Assessment Report projections of global mean temperature for six representative emissions scenarios and a range of climate sensitivities. Simulated crop yield changes by the 2080s relative to the period 1961-90 according to a high emission scenario (IPCC A2) and two different climate models. The potential increases in yield exhibited by wheat, rice, maize and soybean under elevated levels of CO₂. Cereal prices (% of baseline) versus global mean temperature change for major modelling studies

Boxes

Box 3.1.	UKCIP scenarios and decision-making under uncertainty	
Box 3.2.	Uncertainties in climate models	
Box 3.3.	Special Report on Emissions Scenarios description	54
Box 5.1.	The New Zealand Emissions Trading Scheme	91
Box 6.1.	Biofuels as a mitigation strategy	94