Main Findings of IPCC AR4 on Agriculture

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Outline

- Main findings in adaptation
- Baseline emission trends and drivers
- Mitigation potentials by regions and carbon price
- Contribution to mitigation in energy sector
- Limitations of AR4
- Key messages on agriculture from IPCC AR4
- Final comments on C sequestration in soils
Impacts, Adaptation

- Warming will decrease yields in seasonally dry and tropical regions. Positive effects in temperate regions.
- The number of people at risk of hunger tends to decrease with development. Climate change will attenuate this decrease, and cause localized increases (e.g., sub-Saharan region).
- Adaptation measures exist (change in practices, relocation). Beyond 3°C warming, adaptation not possible in low latitudes.
- Small landholders/subsistence farmers will suffer localized impacts (climate variability, snow-pack decrease, disease, …).
- Food trade expected to increase, with most developing countries becoming more dependent on food imports.
- CO₂ enrichment increases crop yields (particularly C₃ crops) under unstressed conditions.
Baseline emissions: Agriculture

**Main drivers for trends**

- **Increase in GHGs:** population pressure, income increase, diet changes, technological changes
- **Decrease in GHGs:** increased land productivity, conservation tillage, non-climate policies
### Economic Mitigation Potential in 2030

<table>
<thead>
<tr>
<th>Carbon price (US$/tCO₂-eq)</th>
<th>Mitigation Potential (Gt CO₂-eq/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>1.6 (0.3-2.4)</td>
</tr>
<tr>
<td>50</td>
<td>2.7 (1.5-3.9)</td>
</tr>
<tr>
<td>100</td>
<td>4.4 (2.3-6.4)</td>
</tr>
<tr>
<td>Emissions 2030</td>
<td>8.2</td>
</tr>
</tbody>
</table>

**Mitigation practices in Agriculture**
- Cropland management;
- Restoration of organic soils;
- Rice management;
- Grazing land management – 90% of potential is carbon sequestration
Mitigation Potentials by Sector

Relative contribution of Agriculture to total mitigation potential
US$ 20/tCO2 – 12%
US$ 50/tCO2 – 14%
US$ 100/tCO2 – 19%
70% of technical potential is in developing regions

2/3 of potential not covered by Kyoto mechanisms
Contribution to Energy Sector

- Biomass as energy feedstock produced in agricultural land may cause indirect emissions reductions of 70-1,260 Mt CO$_2$-eq./yr (at US$ 20/tCO2) by 2030.
- In addition, emissions reductions of 770 Mt CO$_2$-eq./yr can be achieved through energy efficiency.
- Associated impacts:
  - Competition with other land uses, positive or negative environmental impacts, implications for food security.
Limitations of the Assessment

- Mitigation potential in livestock systems may have been underestimated. Emphasis was on per-head emissions, but relevance of per-unit-product emissions (i.e., getting certain amount of products with lesser animals) was overlooked.

- Some possible synergies between mitigation options were not quantified (e.g., grazing land/cropland productivity and reduced deforestation)

- Estimates of some options with possibly good potential (lifestyle changes) are not provided

- Sink enhancement or reversal due to climate change are identified, but uncertainties remain high
Key Messages

• Carbon sequestration in agricultural soils has a mitigation potential of 1 to 4 billion t CO₂/yr at carbon prices of 20 to 100 US$/tCO₂
  – This represents between 11 and 17% of total mitigation potential
  – C stock in soils is highly correlated with productivity/resilience and soil conservation
  – Links with REDD

• 70% of mitigation potential is in developing regions
  – This potential was neglected by Kyoto, thus wasting an opportunity for adaptation and sustainable development benefits.

• Potential of mitigation of livestock emissions may have been underestimated (especially for grazing systems in warm regions).
The report of IPCC Working Group III is available at
www.mnp.nl/ipcc
## A Mitigation Potential Largely Missed by Kyoto

<table>
<thead>
<tr>
<th>Mitigation Practice</th>
<th>Economic Potential</th>
<th>Kyoto Mechanisms</th>
</tr>
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<tbody>
<tr>
<td>C sequestration in agricultural lands</td>
<td>4.0 (2.8/1.2)</td>
<td>~0 (three AI Parties)</td>
</tr>
<tr>
<td>Afforestation / Reforestation / Agroforestry</td>
<td>0.8 (0.6/0.2)</td>
<td>n/e (nil in NAI Parties)</td>
</tr>
<tr>
<td>Reduced emissions from deforestation</td>
<td>0.8 (0.7/0.1)</td>
<td>n/e (nil in NAI Parties)</td>
</tr>
<tr>
<td>Forest management</td>
<td>1.3 (0.7/0.6)</td>
<td>0.2 (20 AI Parties)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6.9 (4.8/2.1)</strong></td>
<td><strong>&lt;0.5</strong></td>
</tr>
</tbody>
</table>

Annex I countries: net sink of 1.2 Gt CO₂ in 2004
Policy Relevant Issues

• Permanence
  – Temporary credits for AR CDM, a big failure
  – Buffer reserve approach (e.g., VCS) is a more effective mechanism

• Measurement of emissions and removals
  – IPCC Good Practice Guidance 2003 and IPCC Guidelines 2006 provide a sound basis to achieve reasonable accuracy
  – Uncertainties remain high for non-CO₂ gases

• Baselines
  – Agricultural emissions: adoption of carbon intensity baselines (i.e., per-unit-product emissions) should be more effective than baselines based on absolute emissions. Potential conflict with trade issues (e.g., subsidies, embedded carbon)

• Any restrictions to the trade of C credits will reduce the mitigation potentials and/or increase the market price of carbon