Future environmental challenges in Europe

A cross-sectoral approach
An ecosystem approach

To account for what matters
Progress so far

• 6th Environmental Action Programme good way through its implementation
• Review during 2010 will shed a light on progress regarding legal implementation
• Across all environmental legislation basic principals relate to:
  • Balancing of flows of goods and services keeping a good status throughout all ecosystems
  • Increase Eco-efficiency (carbon and water)
  • Internalisation of external costs (account for what matters)
The three main challenges

Tackling Climate Change regarding Mitigation and Adaptation

Halt the loss of Biodiversity; and maintain our ecosystems in an integrated way, valuing their goods and services

Using our land and soils in Agriculture and urban development in a sustainable way, stop the high disturbance of our ecosystems incl. Biodiversity, water and air
Halting the loss of Biodiversity by 2020

- European biodiversity continuously under pressure - [EEA report 4/2209](#)
- Main threats being habitat loss, fragmentation (e.g. forests), Climate change and invasive species

**Some progress:**
- improvements in water and air quality
- 17% of EU land area in Natura2000 networks
- 16% protected under national instruments

→ ecological footprint shows that demand exceeds the total biocapacity (capacity for biological production and absorption of waste); agriculture being a major threat
Article 17 agricultural biodiversity reporting trends 2000-06

Habitats dependant on agriculture (204 assessments)

- 52% Favourable (FV, ‘green’)
- 24% Unfavourable – inadequate (U1, ‘amber’)
- 13% Unfavourable – bad (U2, ‘red’)
- 4% Unknown (XX, ‘grey’)
- 0% Beneficial (X or I)

Habitats not dependant on agriculture (497 assessments)

- 30% Favourable (FV, ‘green’)
- 30% Unfavourable – inadequate (U1, ‘amber’)
- 13% Unfavourable – bad (U2, ‘red’)
- 13% Unknown (XX, ‘grey’)
- 1% Beneficial (X or I)
- 5% Other (X or I)
Ecosystem Accounts & National Accounts Adjustment:

**Total Ecological Potential**

- **Ecosystem Dependency**
  - (land, soil, energy, water, N,P,K...)

- **Biodiversity Rarefaction**
  - (loss of adaptability)

- **HANPP**
  - (biomass diverted from Nature)

- **Landscape Ecological Potential**
  - (the landscape radiography)

- **Healthy Populations**
  - (human and wildlife)

- **Catchments Exergy Loss**
  - (from water evaporation & pollution)

**Multi-criteria rating**
Projected Future Warming

- A2
- A1B
- B1
- Year 2000 Constant Concentrations
- 20th century

Global surface warming (°C)

Year

1900 2000 2100

- B1
- A1T
- B2
- A1B
- A2
- A1F
Climate change impacts and consequences - adaptation?

- Increasing frequencies of extreme events - Droughts AND Floods
- Shifts in biodiversity/living conditions with consequences for food supply
- Heat weaves and effects on human health
- Risk of increasing migration and global social imbalances

EEA climate change impact report 4/2008
Oil is the real problem - it is the fuel of transportation

- Oil accounts for 32% of global energy consumption
- Demand is growing
- Non-Opec production is declining
- Major politically-induced constraints

European offshore oil production forecast

© Energyfiles Ltd

Picture courtesy Transfuture.net
Climate change mitigation – new approach to energy - low carbon society

- Current focus on Bioenergy bears risks to water and ecosystems by further intensification of agriculture
- Renewable potentials have to be exploited and developed regionally specific (solar, water geothermic)
- Savings and smart – grids facilitating the delivery of renewable energy have to be fostered
- Nexus energy – water
- Eco-efficiency is key
ENERGY AND WATER RELATIONSHIPS

WATER FOR ENERGY

- Extraction & Refining
- Fuel Production (Ethanol, hydrogen)

Hydropower

Thermo electric Cooling

Waste Water Treatment

Energy Associated with Uses of Water

Extraction and Transmission

Drinking Water Treatment

ENERGY FOR WATER

(Reiter, IWA WWC 2008)
Sustainable land use and urban development

- Agriculture is still the most critical area affecting environmental quality (effecting biodiversity, water quality and resources)
- Urban development is the key driver behind transport and private car use; we have to make our cities a place worthwhile to live
- The right development of rural and urban areas can be supported by land accounts
Data infrastructure: Land cover/land accounts
Intensive agriculture 2000
Data infrastructure: Land cover/land accounts
Urbanisation 2000
Agriculture: EU-27 GHG emissions, 1990–2007 in CO2 equivalents (Tg)
Agriculture: absolute change in GHG emissions by large key source categories, 1990–2007 in CO2 equivalents (Tg) and 2007 shares

[Graph showing changes in GHG emissions and pie chart for 2007]
Beyond GDP: balancing resources

Agriculture

- part of the problem: globally agriculture 13.5% and forestry 19% global emissions
- part of the solution: biomass, carbon sequestration, soil management;
- eco-efficiency: productivity may need to double over the next 40 years if population allowed to grow to 9 billion,
- indicators: land accounts derived from GlobeCorine (proxy for carbon sequestration, soil sealing, biodiversity), greenhouse gas emissions; land footprint
Beyond GDP: balancing resources

Water

• part of the problem: over abstraction, eutrophication
• part of the solution: eco-efficiency in water use, irrigation techniques, plant varieties
• indicators: water accounts (upgrade of water use statistics and accounts; breakdown by catchments and for large urban areas; irrigation water); water protection and management expenditures by catchments or basin districts; water footprint
Irrigation; up to 80% of total water abstraction
Water resources and electricity use

Maintaining stocks-Recycling flows

Deliver clean water (kW/hours/1000 liters)...

From lake or river = 5.6

From groundwater = 7.2

From wastewater = 11
## Resource footprints of biofuels production

### Water footprint (Liters/1 liters of ethanol)...

<table>
<thead>
<tr>
<th>Crop</th>
<th>Footprint (L/1L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar beet (EU)</td>
<td>1.400</td>
</tr>
<tr>
<td>Sugarcane (Brazil)</td>
<td>2.400</td>
</tr>
<tr>
<td>Maize (USA)</td>
<td>2.600</td>
</tr>
</tbody>
</table>

### Land footprint (Hectares/1000 liters of ethanol)...

<table>
<thead>
<tr>
<th>Crop</th>
<th>Footprint (Ha/1000L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugarcane (Brazil)</td>
<td>0.11</td>
</tr>
<tr>
<td>Sugar beet (EU)</td>
<td>0.125</td>
</tr>
<tr>
<td>Maize (USA)</td>
<td>0.65</td>
</tr>
</tbody>
</table>
Water resource footprint of biofuels use

Water footprint to travel 100 Km (Liters)...

Ethanol car in USA = 15,000
Ethanol car in Brazil = 300
Plug-in hybrid car = 56
Gasoline car = 24
# Carbon and electricity economics

## Convenient solutions-inconvenient implications

### Carbon footprint (gCO2/kW/hour)
- Nuclear = 5
- Crops = 5-80
- Gas/steam = 400
- Coal/oil = 800

### Capital costs US$/kW/hour)
- Gas/steam = 717
- Crops = 1,500
- Coal/oil = 1,534
- Nuclear = 2,475

### Generation cost (US$/kW/hour)
- Crops = 0.05
- Coal/oil = 0.3
- Nuclear = 0.33
- Gas/steam = 0.47
Eco-efficiency in agriculture: crops for food...feed...fuel
New forms of vertical farming
...a fast cropping concept!
new areas to occupy
Adapting urban space – tomorrow’s home of 82% of Europeans
Cooling down with air trees

Viva Madrid!
Eco-efficiency means rethinking how we manage the planet’s natural resources