A dialogue about how we are shaping the future of the planet

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‘Laudato Si’

I “What Is Happening to Our Common Home?”
   Environmental degradation and climate change

II “The Gospel of Creation”
   No biblical justification for anthropocentrism

III “The Human Roots of the Ecological Crisis”
   A technocratic paradigm

IV “Integral Ecology”
   Awareness of the interconnectedness of creation

V “Lines of Approach and Action”
   Imperative to switch from fossil fuels to renewables

VI “Ecological Education and Spirituality”
   Consumer choices, priorities - education
“What Is Happening to Our Common Home?”

I  Pollution and climate change

II  The issue of water

III  Loss of biodiversity

IV  Decline in the quality of human life

V  Global inequality

VI  Weak responses

VII  A variety of opinions
“What Is Happening to Our Common Home?”

- Climate change in context
  - Pollution: environmental degradation
  - Depletion of freshwater: loss of biodiversity

- Climate as ultimate environmental threat
  - True nature of challenge
  - Unlike Dyson, Lomborg

- Science of global warming
  - The scientific verdict

- Science left to the scientists
Climate vs Weather

- **Long-term trends**
  
  *Is the global climate of 1900-1950 different from 1950-2010?*

- **Global trends**
  
  *Not local phenomenon*

- **Parameters**

  *Air temperature: ocean temperature*
  
  *Ice-melt (land, sea): sea level*

  *Heat ≠ temperature*

**Do trends in different variables agree?**
The data

**Global warming (1900-2010)**
- Surface temperature (land, sea): up
- Ocean temperature: up
- Ice-melt (land): up
- Ice-melt (sea): up
- Sea level: up

**Clear trend in different variables**
- Independent lines of evidence
- Different datasets
- Different uncertainties/errors
Ice-melt (land and sea)

- Glacier melt
- Ice sheet melt (both poles)
- Sea-ice melt (arctic)

Ice melt → sea level rise

Accelerated warming

Greenland ice sheet

Retreat of the glaciers

Arctic sea-ice
Cause of warming: the greenhouse effect

**Mercury**: closest to the sun

**Venus**: much hotter

**Explanation**: Venus has a large greenhouse effect.
The greenhouse effect

Atmosphere is transparent to most of sun’s heat

**But:** radiation outward from earth absorbed
Earth’s greenhouse gases

• Nitrogen and oxygen do not absorb heat
  Not greenhouse gases

• Water vapour ($H_2O$): 0.2 – 4.0 %
  Evaporation from oceans

• Carbon dioxide ($CO_2$): 0.039% (390 ppm)
  Animals and plants, fossil fuels

• Methane ($CH_4$): 1.8 ppm (2010)
  Wetlands, animals, agriculture, fossil fuels

$CO_2 = \text{most abundant non-condensing GHG}$
Monitoring carbon dioxide

- **Charles Keeling** (1950 - )
  - CO$_2$ from industry?
  - Absorbed by oceans?
  - Direct measurement (Mauna Loa)

- **Burning fossil fuels releases energy**
  - Also releases CO$_2$ into atmosphere

- **Buildup of CO$_2$ in atmosphere**
  - Increase of 40% from 1850

Systematic increase (1958 - )

![Atmospheric Carbon Dioxide](image)
CO$_2$ and fossil fuels

- Fossils formed when plants buried before respiration
- Stored in rock reservoirs; subject to intense heat and pressure
- Digging up and burning fossilized carbon releases energy
- Also releases CO$_2$ into atmos.

**Flux from fossil fuels: 6 GtC/yr**

- Identify by radioactive dating
- Buildup of CO$_2$ in atmosphere

*Increase of 40% from 1850*
Direct evidence

1. Measure $E_{out}$ of atmosphere

   Function of wavelength, time

   Satellite measurements (1970 - )

   Clear dip in microwave region
   Clear increase in dip over 4 decades

2. Measure $T$ of atmosphere

   Function of height

   Stratosphere cooling

   Clear signals of greenhouse effect

Radiation from earth
Conclusions

1. Multiple lines of evidence for warming
   *Surface temps, ocean temps, sea-level rise, ice melt*

2. Multiple lines of evidence for enhanced GHG effect
   *CO₂ increase, radioactive dating, wavelength of absorbed radiation, stratospheric cooling*

Conclude: (IPCC 2007)

*Most of the warming since 1950 very likely (90% prob) due to increase in GHG conc*

*Expect rise of 2-6 °C by 2050*
The future: IPCC scenarios

- **Continued emissions**
  
  *Four scenarios*

- **Committed warming**
  
  *Already in the pipeline*

- **Future warming**
  
  2-6 °C by 2050
  
  *Worst case scenarios*

- **Actually worse again**
  
  *Feedbacks and tipping points*
Climate feedbacks

- Reduced albedo
  *Melting of ice sheets reduces reflectivity*

- Reduced permafrost
  *Releases methane and CO2*

- Ocean vents
  *Release of methane from ocean vents*

- Tipping points
  *Past climates show accelerated warming*
Consequences

- Increased drought, desertification
  Africa, USA, Australia

- Increased flooding
  China, India, Bangladesh, Tuvulu
  Poorest worst affected (Robinson)

- Frequent extreme events
  Warmer air holds more moisture

- War
  Longterm conflicts over resources
  Large scale emigration
Fixing climate

- **Reduce GHG emissions**
  - Reduce fossil fuel use
  - Remove fossil fuel subsidies
  - Reduce hydraulic fracking

- **Impose international targets**
  - Developed vs developing nations
  - Concerted global action

- **Invest in renewable energy**
  - Increase subsidies for renewables
  - Create climate of investment
  - Economics based on sound science

Unsound science
Climate skepticism

- ‘It’s just a theory’
  
  *Role of evidence misunderstood*

- Media discussions poor/biased
  
  *Expertise vs opinion or vested interest*

- Opposition from ff industry
  
  *Lobbyists, propagandists*

- Resistance from politics
  
  *Conservative values*
Summary

- **A clear and present danger**
  
  *Action required*

- **Understood by scientists**
  
  *Clear solution (difficult)*

- **Not accepted by society**
  
  *Lack of knowledge or trust in science*
  
  *Influence of politics, lobbyists and the media*

- **Prognosis poor**
  
  *No solution without acceptance*