POPULATION DYNAMICS, ENVIRONMENTAL & CLIMATE CHANGE

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Population-Development-Environment Model

Population

by age, gender, education and other socio-economic characteristics

Changes through: fertility, mortality, migration, schooling, HIV/AIDS, and other social movements

Government Policy
- social
- economic
- environmental

Consumption
by economic sector

Production
by economic sector

Development

Domestic trade
International trade

Energy
by source and use

Air
- Changes in composition
- Winds
- Humidity
- Temperature

Land
- Soil composition
- Topography
- Land cover and use

Water
- Rainfall
- Streamflow
- Man-made systems
- Lakes and sea
- Groundwater
Population dynamics, a key determinant of climate and environmental risks

Source: IPCC, 2014
Global changes in wildfire risks

Source: Knorr and Jiang 2017, Nature Climate Change
Integrated Population-Economy-Technology Science (iPETS) Model

Community Demographic Model

HH Behavior

PET

CO₂ Emissions

Labor Capital Land

Final Goods

Energy Materials

Intermediate Goods Producers

OIL, Gas, Coal, Electricity

Refined Fuels

Agriculture, Forestry, Animal Products, and Materials

Earth System Models

Spatial Models

Emissions

GDP

Population

CESM

ISAM

CLM or ISAM
IPCC New Socioeconomic Scenarios: Shared Socioeconomic Pathways (SSPs)

- **SSP5**: Rapid Growth
- **SSP2**: Middle of the Road
- **SSP3**: Regional Rivalry
- **SSP4**: Inequality
- **SSP1**: Sustainability

Challenges to Mitigation

Challenges to Adaptation

Source: Jiang, 2014, Pop & Env.
SSPs Global Projection Results: changes relative to 1950

**population size; urbanization; mean year of schooling; per capita GDP**

Source: Jiang, 2014, Pop & Env.
Population Scenarios:

meeting the unmet need for family planning leads to 0.5 fewer births, reduces population projection from UN high to medium

Source: O'Neill et al 2010, PNAS.
Carbon Emissions Results

Source: O’Neill et al 2010, PNAS.
Carbon Emissions Results

Source: O'Neill et al 2010, PNAS.
Investment in education leads to slow population growth and slightly higher emissions
Proportion of consumption of households by education

Food

Expenditure share

Nepal  India  China  Korea

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E1  E2  E3  E4
Proportion of consumption of households by education

Energy

Expenditure share

Nepal | India | China | Korea

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E1 | E2 | E3 | E4
Investment in education leads to substantially improving adaptive capacity (HDI)
Conclusion

• Population dynamics play a key role in sustainable development
• Changes in population sizes, composition, and distribution are important for meeting climate change mitigation and adaptation challenges
• Investments in education and reproductive health, changes in consumptive and productive behavior are crucial for achieving inclusive economic growth and sustainable development goals