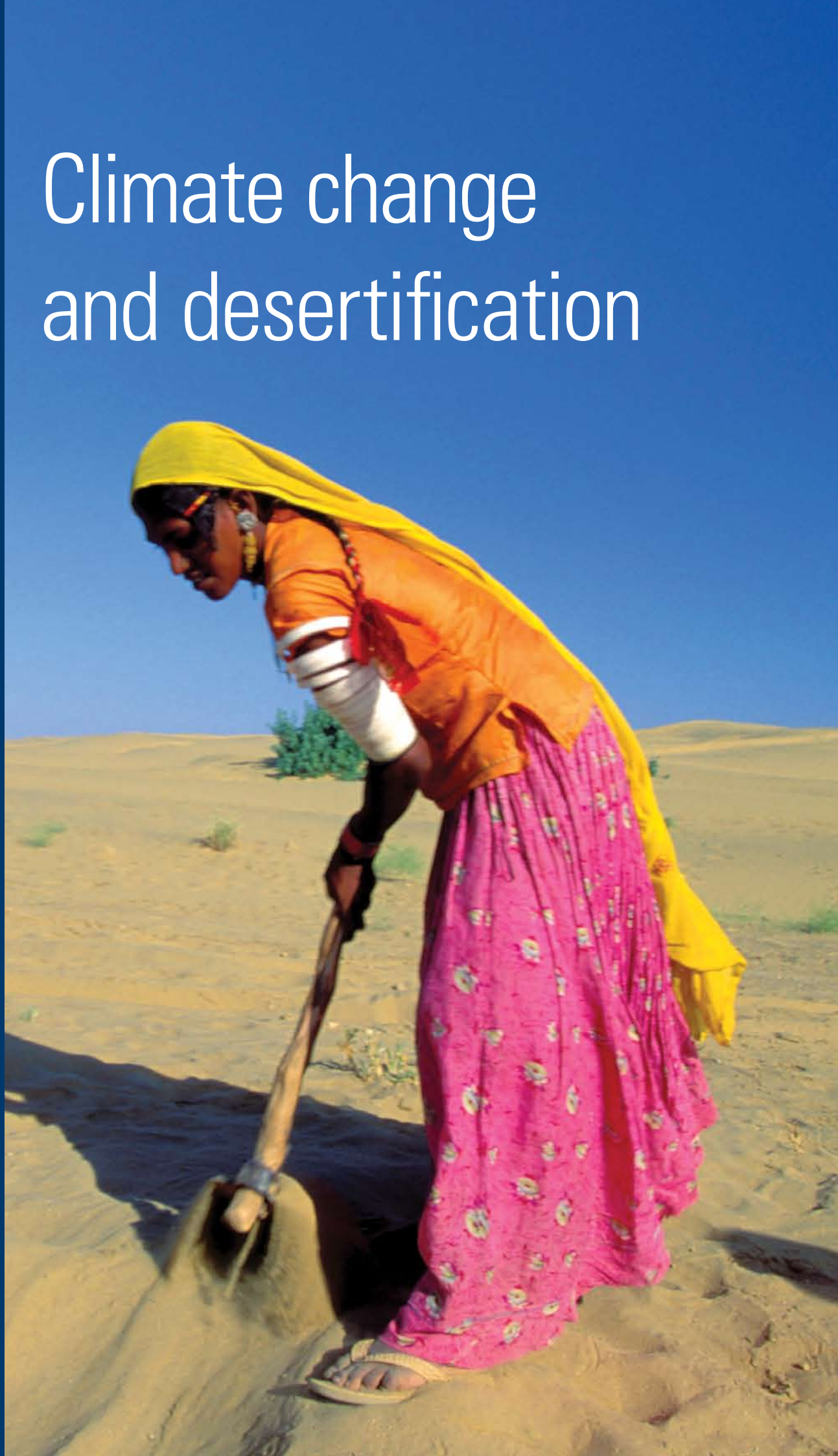
Climate change and desertification



World Meteorological Organization

Weather • Climate • Water

HUMAN AND NATURAL DRIVERS OF CLIMATE CHANGE

Human activities—primarily burning of fossil fuels and changes in land cover—are modifying the concentration of atmospheric constituents or properties of the Earth's surface that absorb or scatter radiant energy. Global atmospheric concentrations of carbon dioxide, methane and nitrous oxide have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years.

The global atmospheric concentration of carbon dioxide increased from a pre-industrial value of about 280 ppm to 379 ppm in 2005. That of methane increased from a pre-industrial value of about 715 ppb to 1732 ppb in the early 1990s, and was 1774 ppb in 2005. The global atmospheric nitrous oxide concentration increased from a pre-industrial value of about 270 ppb to 319 ppb in 2005.

The primary source of the increased atmospheric concentration of carbon dioxide since the pre-industrial period results from fossil fuel use, with land use change providing another significant but smaller contribution. It is very likely that the observed increase in methane concentration is due to anthropogenic activities, predominantly agriculture and fossil fuel use. More than a third of all nitrous oxide emissions are anthropogenic and are primarily due to agriculture.

DIRECT OBSERVATIONS OF RECENT CLIMATE CHANGE

Eleven of the last twelve years (1995 -2006) rank among the 12 warmest years in the instrumental record of global surface temperature (since 1850). The total temperature increase from 1850–1899 to 2001–2005 was 0.76°C.

At continental, regional, and ocean basin scales, numerous long-term changes in climate have been observed. These include changes in Arctic temperatures and ice, widespread changes in precipitation amounts, ocean salinity, wind patterns and aspects of extreme weather including droughts, heavy precipitation, heat waves and the intensity of tropical cyclones. More intense and longer

droughts have been observed over wider areas since the 1970s, particularly in the tropics and subtropics.

PROJECTIONS OF FUTURE CHANGES IN CLIMATE

Projected warming in the 21st century is expected to be greatest over land and at the highest northern latitudes. For the next two decades a warming of about 0.2°C per decade is projected. Increases in the amount of precipitation are very likely in high latitudes, while decreases are likely in most subtropical land regions. Drought-affected areas will likely increase in extent. It is very likely that hot extremes, heat waves and heavy precipitation events will continue to become more frequent.

Given these projections of future climate change, there will be increased land degradation owing to droughts and increased soil erosion owing to heavy rainfall events.

CLIMATE CHANGE AND DESERTIFICATION

Carbon dioxide-induced climate change and desertification remain inextricably linked because of feedbacks between land degradation and precipitation. Water resources are inextricably linked with climate. Annual average river runoff and water availability are projected to increase by 10-40% at high latitudes and in some wet tropical areas, and decrease by 10-30% over some dry regions at mid-latitudes and in the dry tropics. Soils exposed to degradation as a result of poor land management could become infertile as a result of climate change.

Climate change may exacerbate desertification through alteration of spatial and temporal patterns in temperature, rainfall, solar radiation and winds. The impacts can be described as follows:

- Soil properties and processes—including organic matter decomposition, leaching, and soil water regimes—will be influenced by temperature increase;
- At lower latitudes, especially seasonally dry and tropical regions, crop productivity is projected to decrease for even small local temperature increases (1-2°C);
- Agricultural production in many African regions is projected to be severely compromised by climate variability and change. The area suitable for agriculture, the length of growing seasons and yield potential, particularly along the margins of semi-arid and arid areas, are expected to decrease;
- In the drier areas of Latin America, climate change is expected to lead to salinisation and desertification of agricultural land;
- In Southern Europe, higher temperatures and more frequent drought are expected to reduce water availability, hydropower potential, and, in general, crop productivity.

ACTION TAKEN BY WMO TO ADDRESS CLIMATE CHANGE AND DESERTIFICATION ISSUES

WMO contributes to the understanding of interactions between climate change and desertification through its Agricultural Meteorology Programme, Hydrology and Water Resources Programme, World Climate Programme and other scientific and technical programmes by:

(a) Advocating enhanced observing systems at national, regional and international levels;

(b) Promoting effective early warning systems, which also serve as an essential alert mechanism to combat land degradation;

(c) Further enhancing climate prediction capability and associated operational applications;

(d) Assessing vulnerability and analyzing hazards by employing the knowledge of vulnerability at local, national and regional levels;

(e) Implementing risk management applications to combat droughts and mitigate floods;

(f) Helping to strengthen the capabilities of countries and regional institutions through drought-related programmes and promoting collaboration with other institutions in drought- and desertification-prone regions.

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