

base as a consequence of reduced crop-water availability, two broad sets of regions appear most vulnerable to climate change: (i) some semi-arid, tropical and subtropical regions (such as western Arabia, the Maghreb, western West Africa, Horn of Africa and southern Africa, eastern Brazil), and (ii) some humid tropical and equatorial regions (such as Southeast Asia and Central America).

In addition, certain regions that are currently net exporters of cereals could also be characterised by reduced productive potential as a result of climate changes. Any decrease in production in these regions could markedly affect future global food prices and patterns of trade. These regions might include, for example, Western Europe, southern US, parts of South America, and Western Australia.

Effect of altered climate extremes

Relatively small changes in the mean values of rainfall and temperature can have a marked effect on the frequency of extreme levels of available warmth and moisture. For example, the number of very hot days which can cause damaging heat stress to temperate crops and livestock could increase significantly in some regions as a result of a 1°C to 2°C increase in mean annual temperatures. Similarly, reduction in average levels of soil moisture as a result of higher rates of evapotranspiration could increase substantially the number of days below a minimum threshold of water availability for given crops.

Although at present we know little about how the frequency of extreme events may alter as a result of climate change, the potential impact of concurrent drought or heat stress in the major food-exporting regions of the world

could be severe. In addition, relatively small decreases in rainfall, changes in rainfall distribution or increases in evapotranspiration could markedly increase the probability, intensity and duration of drought in currently drought-prone (and often food-deficient) regions. Increase in drought risk represents potentially the most serious impact of climate change on agriculture at both the regional and global level.

Effects on crop growth potential, land degradation, pests and diseases

Higher levels of atmospheric CO₂ are expected to enhance the growth rate of some staple cereal crops, such as wheat and rice, but not of others such as millet, sorghum and maize. The use of water by crop plants may also be more efficient under higher CO₂ levels. However, it is not clear how far the potentially beneficial 'direct' effects of enhanced atmospheric CO₂ will be manifested in the farmer's field.

Warming is likely to result in a poleward shift of thermal limits of agriculture, which may increase productive potential in high-latitude regions. But soils and terrain may not enable much of this potential to be realised. Moreover, shifts of moisture limits in some semi-arid and sub-humid regions could lead to significant reductions of potential with serious implications for regional food supplies in some developing countries. Horticultural production in mid-latitude regions may be reduced owing to insufficient accumulated winter chilling. The impact of climate change will be far greater for long-lived horticultural fruit crops, with long establishment periods, than for annual crops where new cultivars can quickly replace others.

Temperature increases may extend the geographic range of some insect pests,