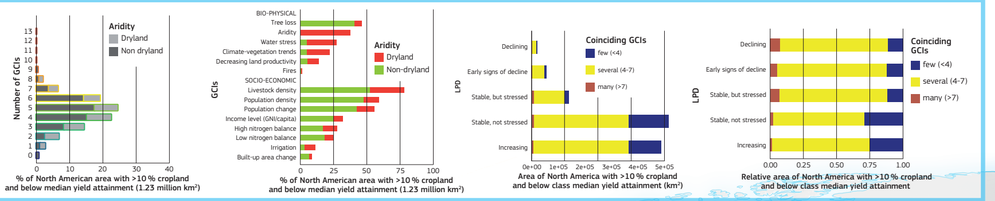
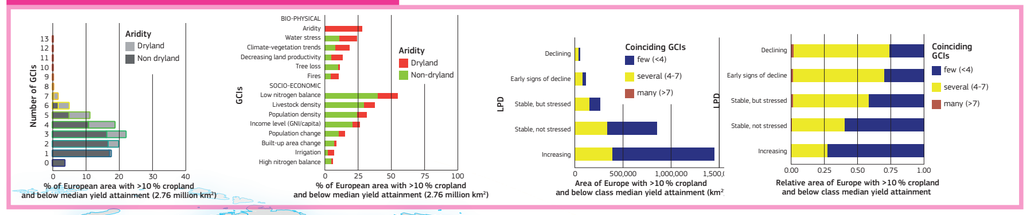
Convergence of Evidence: Cropland with Yield Gaps

Cropland with yield gaps are areas where > 10 % of each grid cell (1 km²) has yields less than the median values for 17 major crops

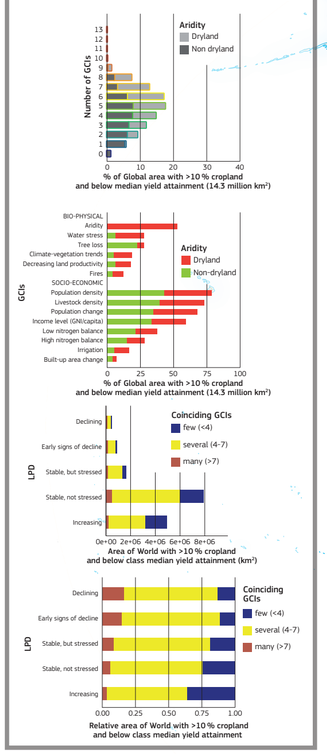
Distributions of predominant issues in NORTH AMERICA

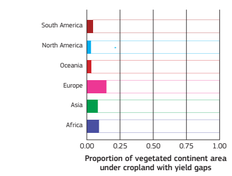


Distributions of predominant issues in EUROPE

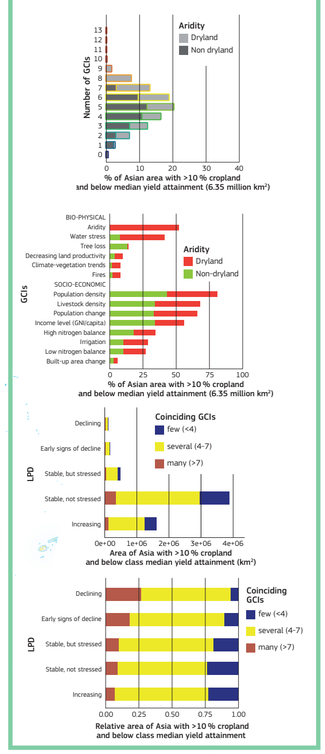


Distributions of predominant issues in WORLD

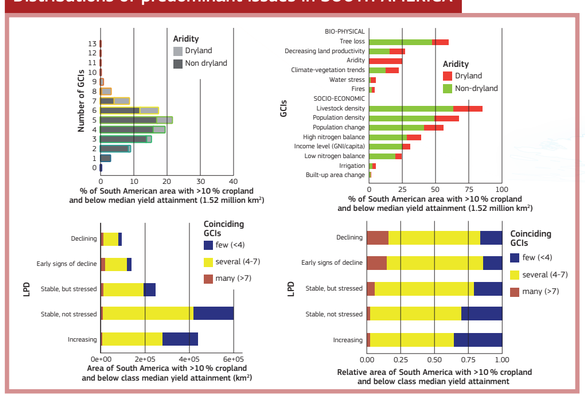




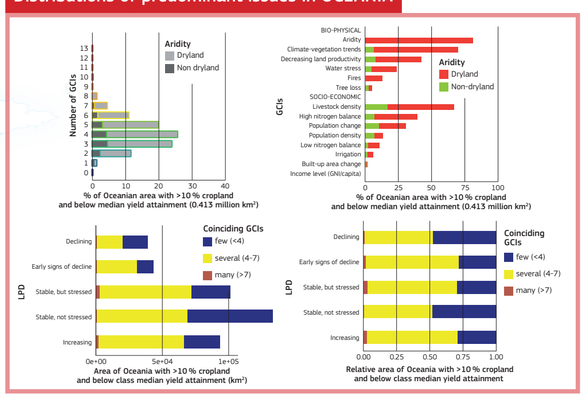
Distributions of predominant issues in ASIA



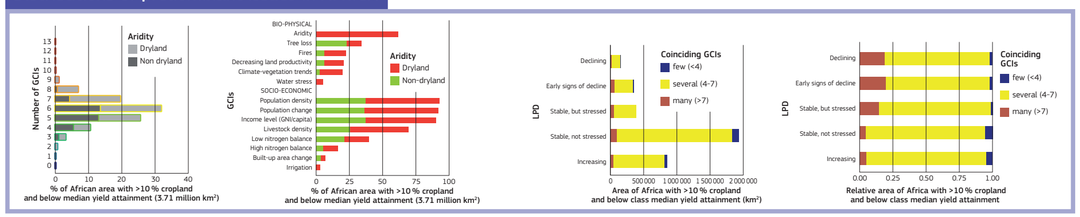
Distributions of predominant issues in SOUTH AMERICA



Distributions of predominant issues in OCEANIA



Distributions of predominant issues in AFRICA



See previous page for explanatory text.

Number of coincident issues

0 1 2 3 4 5 6 7 8 9 10 11 12 13

Convergence of Evidence: Cropland with Yield Gaps

See next spread for data.

Examples of global regions where cropland with yield gaps are affected by global change issues (GCIs; see Table, page 145 and see Closing Yield Gaps, page 52) include:

- Africa: Morocco, Tunisia, Nile delta in Egypt; Gedaref area in Sudan, Ethiopia, Kenya, Tanzania, Malawi, Zimbabwe and coastal Senegal;
- Asia: northern Turkey, Yellow River Basin (China); Indus valley (Pakistan), various areas in India;
- Europe: Mediterranean dryland areas, including southern Italy, Spain. Moldovan Dniester valley and northern Belgium.

Global change issues (GCIs) associated with transformations (including land degradation) in cropland with yield gaps include: various biophysical GCIs (water stress, drought conditions (i.e. climate-vegetation trends GCI, see table), decreasing land productivity) and socio-economic GCIs (low income, high population densities, high input agriculture, low input agriculture). Cropland with yield gaps tend to occur in poorer regions of the world, such as in Africa and India, where low income and water stress are especially important GCIs.

Analysis shows that in cropland with yield gaps:

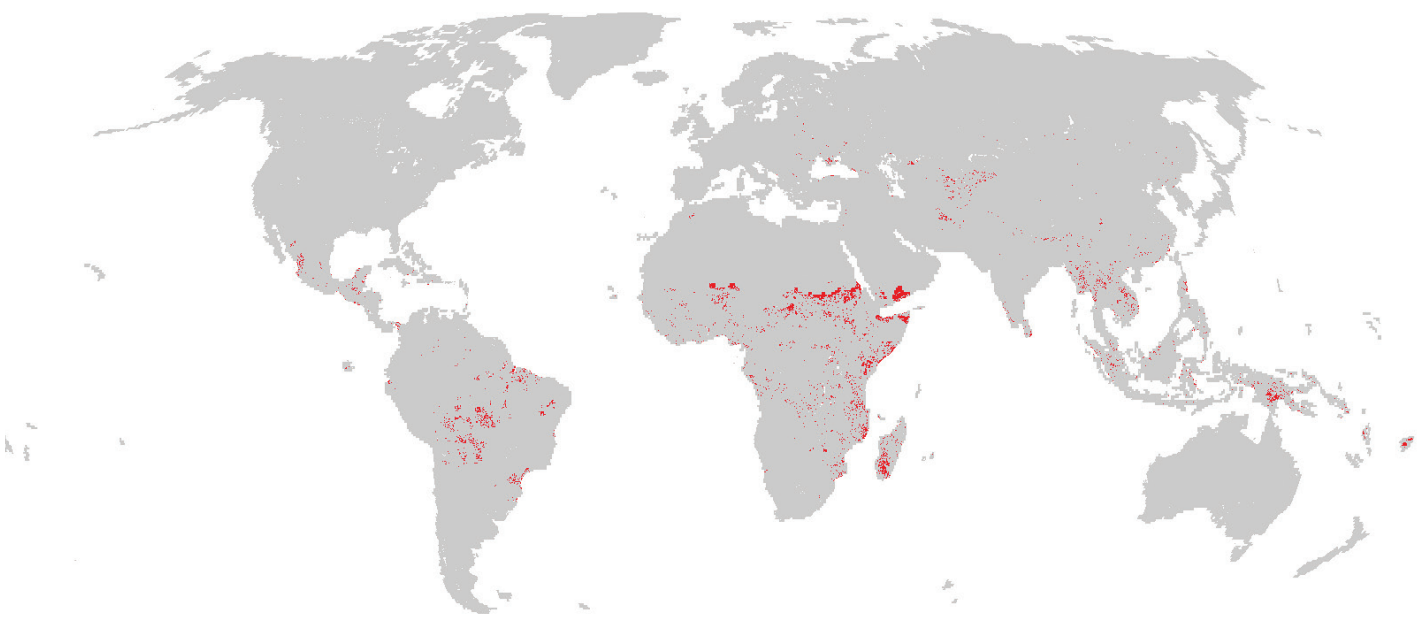
- About 10% (or 0.82 million km^2) of the cropland with yield gaps area experiences potential pressure from 8 to 13 GCIs, which is significantly less than high density cropland. Signs of land productivity decline are observed in 26% of this area (0.22 million km^2).
- Approximately 62% (8.1 million km^2) of the cropland with yield gaps area experiences potential pressure from 4 to 7 GCIs. Signs of land productivity decline are observed in 20% of this area (1.67 million km^2).
- Approximately 26% (4.47 million km^2) of the cropland with yield gaps area experiences potential pressure from 1-3 GCIs. Signs of land productivity decline are observed in 11% of this area (0.48 million km^2).
- Around 2% have no GCIs.
- In 15% of the area with yield gaps, there is a decrease of land productivity that typically coincides with numerous GCIs, such as low input agriculture (28% of the area), and low income (52%).
- Where yield gaps coincide with irrigation, water stress (35% of the area), high input agriculture (27%) and land productivity increase there is the potential for degradation of water resources, as e.g. in northeast China.

Yield gaps exist in about 45% of all cropland area and are more pronounced in low income countries.

At a continental scale, some patterns with regard to cropland with yield gaps and global change issues (GCIs) emerge:

- **Africa**. Coinciding GCIs in most of African cropland with yield gaps are low input agriculture (26% of the area), land productivity decline (21% of the area), high population density with low income (both in 90% of the area) and less than 4% of this cropland is under irrigation. Stress on the land resource is likely due to low intensity cropping, low input technology and low land productivity, especially when combined with a dense, poor and growing populations. The Maghreb area in northern Africa deviates from this pattern because irrigation is more widespread, and combines with other issues associated with drought conditions and urban growth along coastal areas associated with a decline in land productivity in some areas.
- **Asia**. Irrigation (27% of the area), high input agriculture (30% of the area), and stable or increasing land productivity all coincide with current yield gaps. This suggests that agriculture in this area has been intensified in order to close yield gaps to meet the demands of a growing population. However, 40% of the area is under water stress and this agriculture developments potentially place pressure on both land and water resources, such as in Pakistan's Indus valley and northeast China. Large areas in eastern Europe, south Russia and north-central Asia stand out due to their recent historic trajectory from abandonment after the collapse of the former Soviet Union followed by the recent "revival" of low input agriculture in some areas (see page 187).
- **South America**. The Argentine Chaco experienced tree loss (40% of the area), drought conditions, and declining land productivity as a result of land use change from the dry forest to agriculture.
- **Europe**. There are very few coincident GCIs. In 60% of the area, mostly in eastern Europe, there is low input agriculture. Tree loss is found in 20% of the area, including Portugal, northwest Spain, Poland, and Latvia, Lithuania and other areas scattered throughout eastern Europe. High population densities and rapid expansion of built-up areas add to pressures on cropland in Belgium.
- **North America**. Areas of concern are the mid-west United States, Mexico and Cuba. Coinciding GCIs are tree loss (over nearly 40% of the area), water stress, some fire, and high livestock numbers (in 75% of the area). In north-central Mexico also drought conditions coincided.
- **Oceania**. Water stress, irrigation and high livestock density (65% of the area) and high input agriculture (over 38% of the area) are part of a dynamic agriculture.

Concern for land degradation is warranted where yield gaps coincide with low fertiliser use (35%), decreasing land productivity (20%) and low income (60%).



Coincidence of GCIs – low income, low input agriculture (nitrogen deficient) and declining land productivity – in global croplands with yield gaps (red dots indicate where this combination occurs).
Source: WAD3-JRC, 2018.

- Theme layer derived from: FAO GLC-SHARE v1.0[39], 2014 and Mueller N. 2012[41, 42] (see page 53).
- This map has grid cells of 1 km^2.
- Statistics - in total area (km^2) or percentage of total area - are given for both global and/or continental scales.
- Refer to global change issues (GCIs) in the table on page 145.
- Refer to 'how to read the maps' on page 146.