

Forest recovery after disturbance in Canada's forests

Forest disturbance, 1985 to 2010

- Area disturbed by wildfires
- Area disturbed by harvesting

More than 65% of Canada's land area is found in forested ecosystems, with 347 million hectares classified as forest.

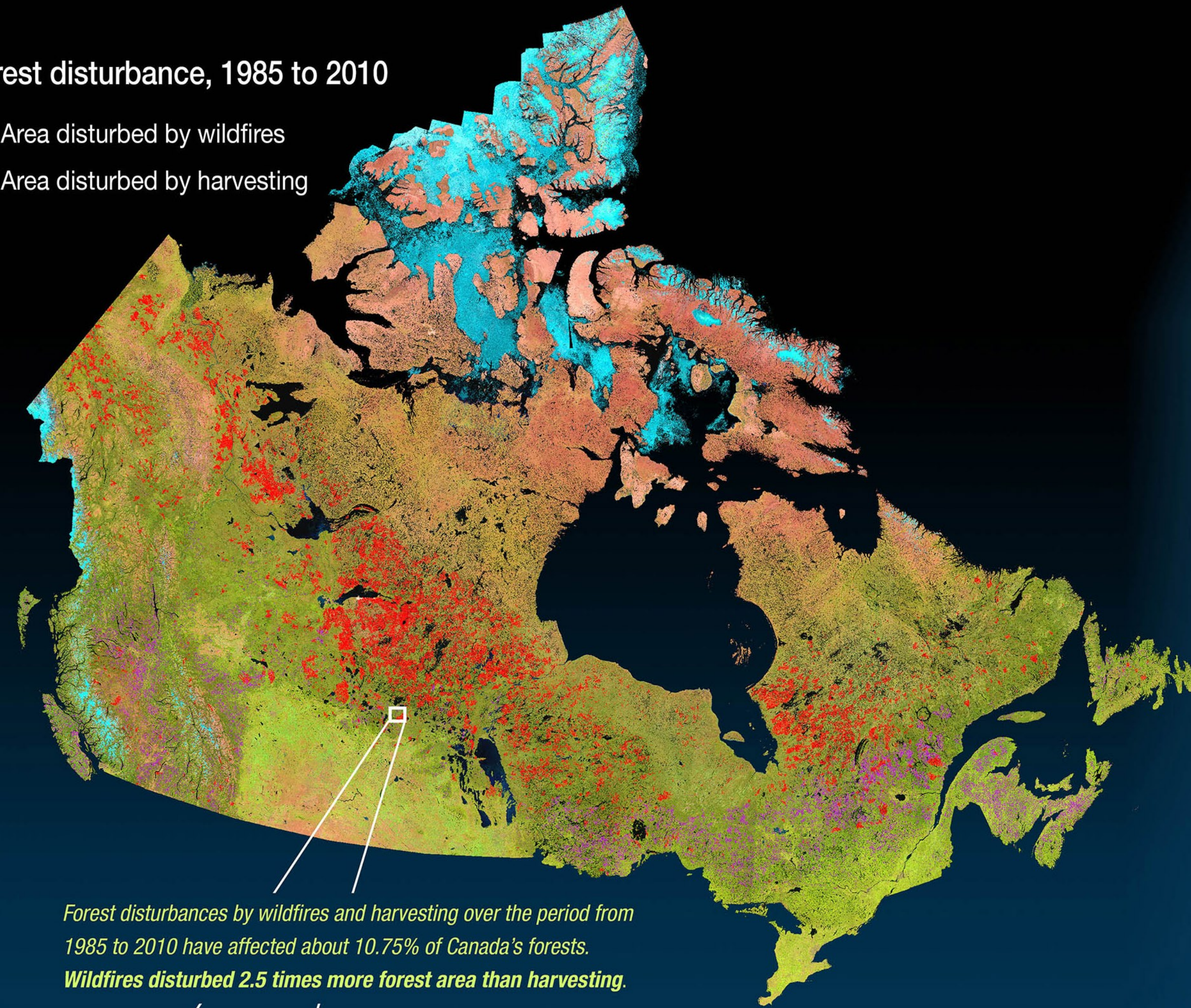
At any given time over such a vast area, wildfires and harvesting, among other disturbances such as insect infestations, disease outbreaks and floods, can affect a few hectares to thousands of hectares of forest and can last from a couple of weeks (smaller fires) to years (insects and diseases).

Access to image data collected by the **Landsat series of satellites** has improved Canada's ability to observe, track and study where wildfires and harvesting have happened and how quickly forests grow back after these disturbances.

These images tell the story of temporary forest loss caused by wildfires and harvesting and show that **forest recovery is a continuous process that ultimately returns most disturbed lands to forest over time**. In fact, by examining the rate of recovery, researchers have found that – on average and over the longer term – **areas disturbed by harvesting have recovered more consistently than areas disturbed by wildfires**.

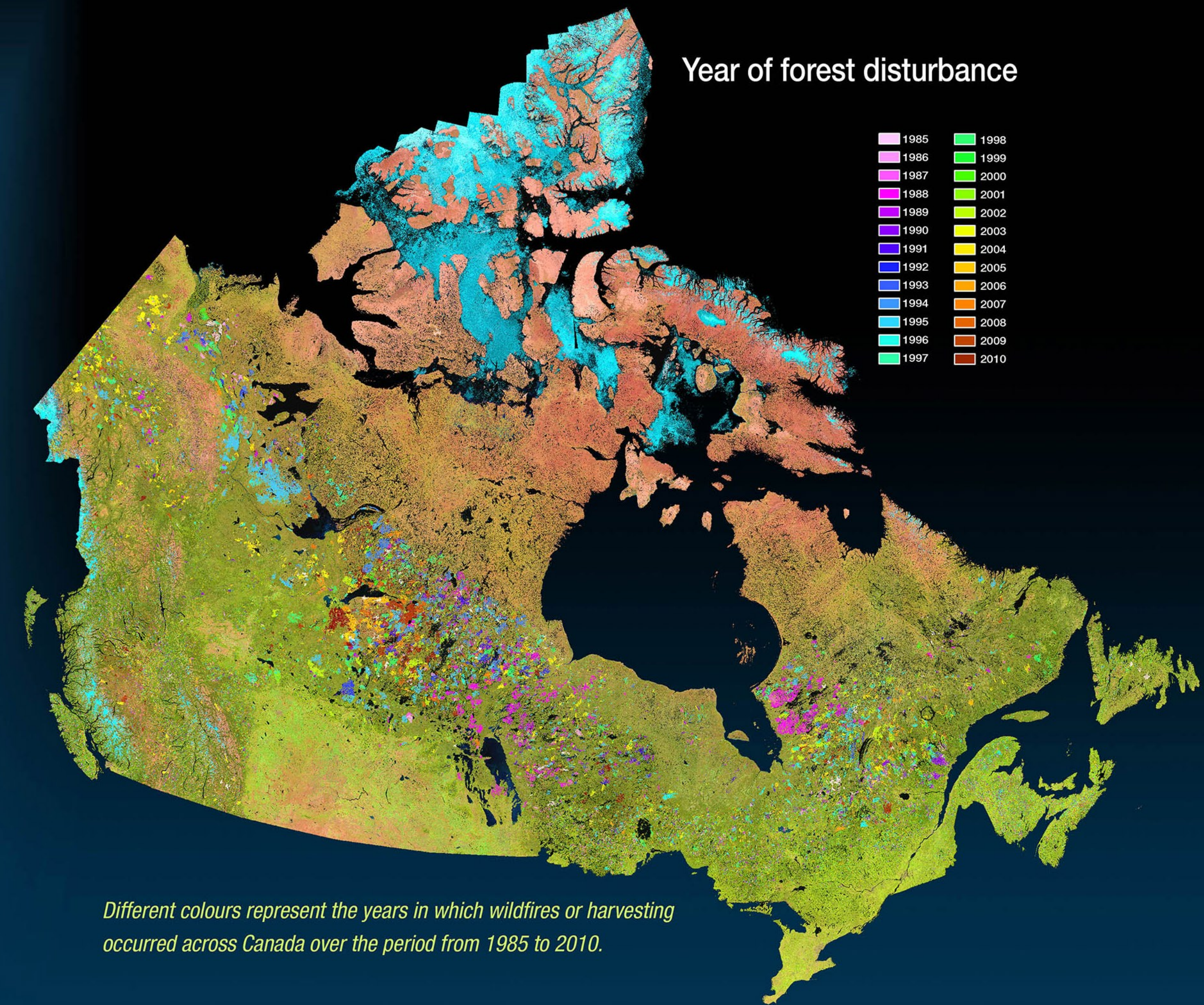
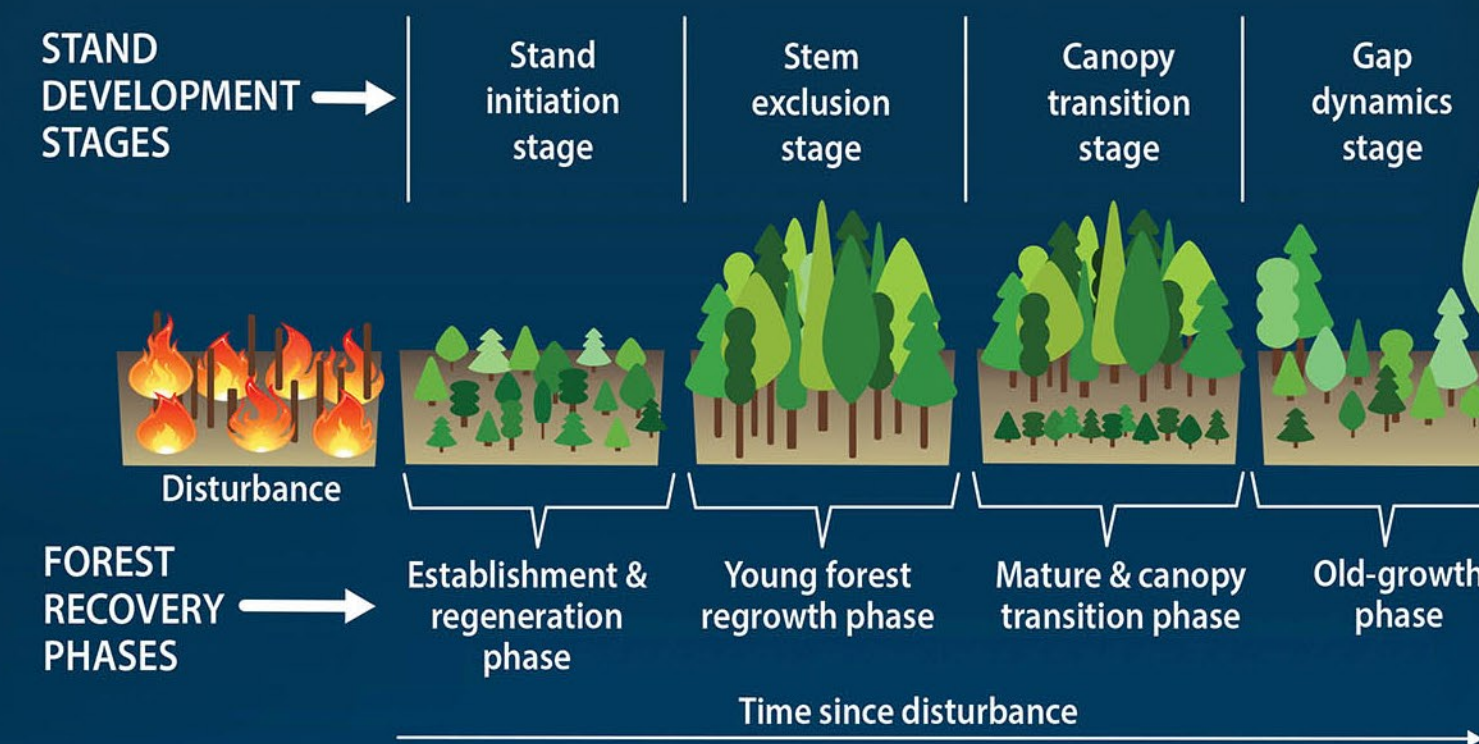
Year of forest disturbance

- 1985
- 1986
- 1987
- 1988
- 1989
- 1990
- 1991
- 1992
- 1993
- 1994
- 1995
- 1996
- 1997
- 1998
- 1999
- 2000
- 2001
- 2002
- 2003
- 2004
- 2005
- 2006
- 2007
- 2008
- 2009
- 2010



Forest disturbances by wildfires and harvesting over the period from 1985 to 2010 have affected about 10.75% of Canada's forests. **Wildfires disturbed 2.5 times more forest area than harvesting.**

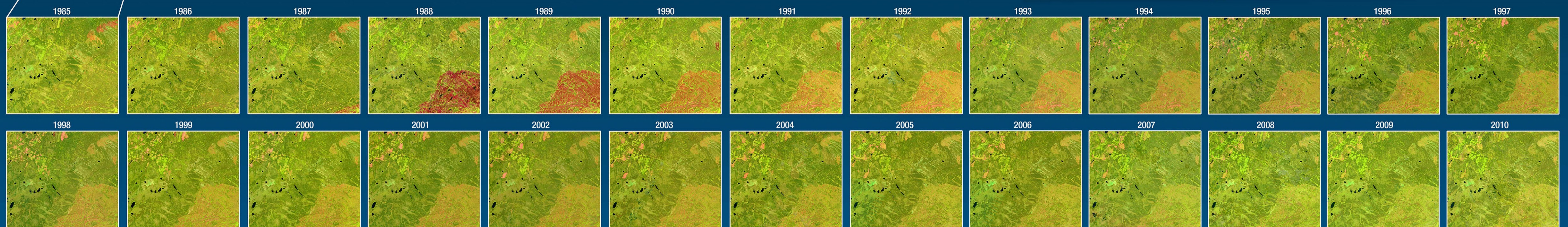
Using Landsat's rich data archive, Natural Resources Canada-Canadian Forest Service researchers have been able to develop detailed maps of forest change – in effect, recreating the recent history of Canada's forests over the period from 1985 to 2010, such as in this forest area located in Saskatchewan.



Different colours represent the years in which wildfires or harvesting occurred across Canada over the period from 1985 to 2010.

The time series below shows that harvesting activities have occurred from 1985 through 2010 (visible in the northeast corner) and that there was a fire in 1988 (the red area in the southeast corner). Vegetation is gradually returning after disturbance in these areas (shades of green).

This ability to monitor specific forest areas year after year has allowed researchers to track progress through stages of forest recovery and stand development and to estimate how many years it has taken forests to return following disturbance.



Contacts: Michael Wulder (mike.wulder@canada.ca), Joanne White (joanne.white@canada.ca)

Key scientific publications:

White, J.C., Wulder, M.A., Hermosilla, T., Coops, N.C., Hobart, G.W. 2017. A nationwide annual characterization of 25 years of forest disturbance and recovery for Canada using Landsat time series. *Remote Sensing of Environment*: 194. <http://dx.doi.org/10.1016/j.rse.2017.03.035>
 Hermosilla, T., Wulder, M.A., White, J.C., Coops, N.C., Hobart, G.W., Campbell, L.B. 2016. Mass data processing of time series Landsat imagery: pixels to data products for forest monitoring. *International Journal of Digital Earth*: 9. <http://dx.doi.org/10.1080/17538947.2016.1187673>
 Hermosilla, T., Wulder, M.A., White, J.C., Coops, N.C., Hobart, G.W. 2015. An integrated Landsat time series protocol for change detection and generation of annual gap-free surface reflectance composites. *Remote Sensing of Environment*: 158. <http://dx.doi.org/10.1016/j.rse.2014.11.005>
 Hermosilla, T., Wulder, M.A., White, J.C., Coops, N.C., Hobart, G.W. 2015. Regional detection, characterization, and attribution of annual forest change from 1984 to 2012 using Landsat-derived time-series metrics. *Remote Sensing of Environment*: 170. <http://dx.doi.org/10.1016/j.rse.2015.09.004>
 White, J.C., Wulder, M.A., Hobart, G.W., Luther, J.E., Hermosilla, T., Griffiths, P., Coops, N.C., Hall, R.J., Hostert, P., Dyk, A., Guindon, L. 2014. Pixel-based image compositing for large-area dense time series applications and science. *Canadian Journal of Remote Sensing*: 40. <http://dx.doi.org/10.1080/07038992.2014.945827>

Acknowledgements:

This research was undertaken as part of the "National Terrestrial Ecosystem Monitoring System (NTEMS): Timely and detailed national cross-sector monitoring for Canada" project jointly funded by the Canadian Space Agency (CSA) Government Related Initiatives Program (GRIP) and the Canadian Forest Service (CFS) of Natural Resources Canada, with collaborators at the University of British Columbia, Integrated Remote Sensing Studio. Archived Landsat data is provided by the United States Geological Survey (USGS).

