Bulletin of Land Surface Dynamics
First half of 2015

E-Science European Infrastructure for Biodiversity and Ecosystem Research

The first half of 2015 was unusually warm in Northern Europe, but local cold spots also occurred. In particular:

- Low snow cover and high NDVI values were observed over North-East Europe in mid-March.
- Exceptional snow cover occurred in Spain during the first two weeks of February.
- Below average temperature and above average rainfall occurred in Kazakhstan.

A huge mortality of saiga antelopes raised concerns for the conservation of this endangered species.

Low snow cover and early start of the vegetation growth in Baltic countries:

Temperatures from mid-February to mid-March 2015 were far above the 1981-2010 mean climatology (Figure 1). The mean temperature anomaly was around +6.5°C in the North of Europe during one month.

Snow melted one month earlier than usual on large areas in the North. Snow cover anomalies (Figure 2) were observed from Mid-February to the end of March 2015: it was the first time that snow had been absent in this region during this period of the year since the first MODIS observations (1999).

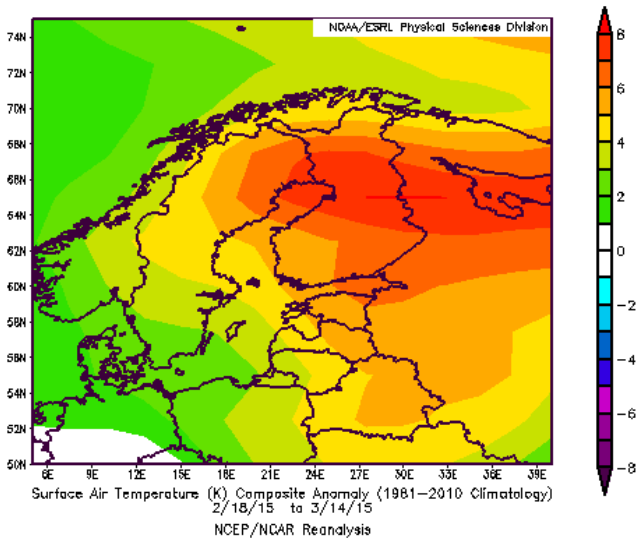


Figure 1: Surface air temperature anomaly between the 18/02/2015 and the 14/03/2015 in Eastern Europe. NCEP/NCAR Reanalysis 1981-2010 Climatology.

Consequently, NDVI levels in Baltic countries, Belarus, West Russia and South Finland were particularly high in mid-March 2015 (Figure 2). The extent of these anomalies was about 525.000 km² (approximately the area of Spain). This above average NDVI (out of the 95% confidence interval) reflects the early start of the vegetation period in that region.

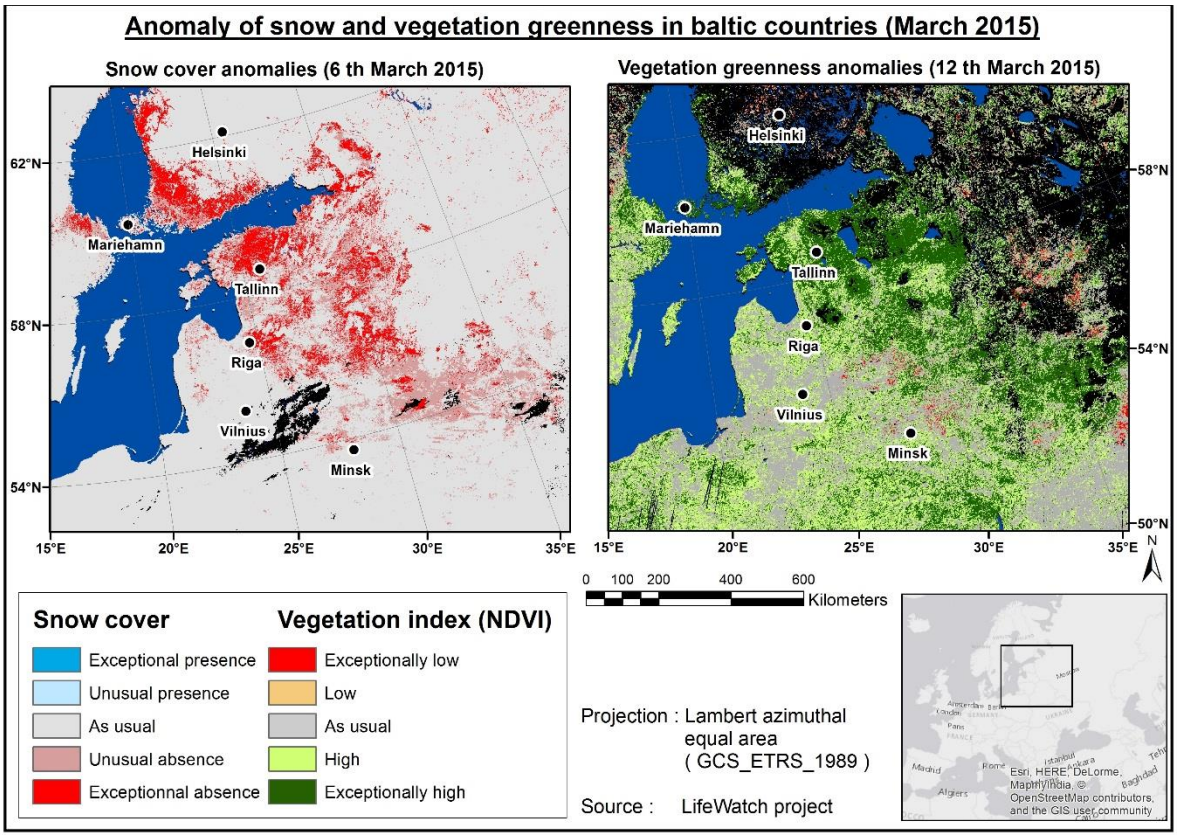


Figure 2: Anomaly of snow and vegetation (NDVI) in Eastern Europe in March 2015. Exceptional absence of snow (in red) and exceptional NDVI (in green) were very broad. Exceptional values are significantly different from the long term average.

Did the lack of vegetation kill the saiga antelopes ?

In May 2015, more than 120.000 saiga antelopes (*saiga tatarica L.,* figure 5), an endangered species, were found dead in the province of Kostanay (Central Kazakhstan). The herds suffered 100% death rate after being infected by bacteria. This unprecedented mortality suggests that a combination of various factors is responsible for the hecatomb. The starvation caused by the locally late vegetation start that we observed is probably one of those factors.

Unusually low temperatures have been recorded in the last week of March 2015 in Kazakhstan (Figure 3). The lowest temperature anomaly took place on the repartition area of the saiga antelopes (Figure 6).

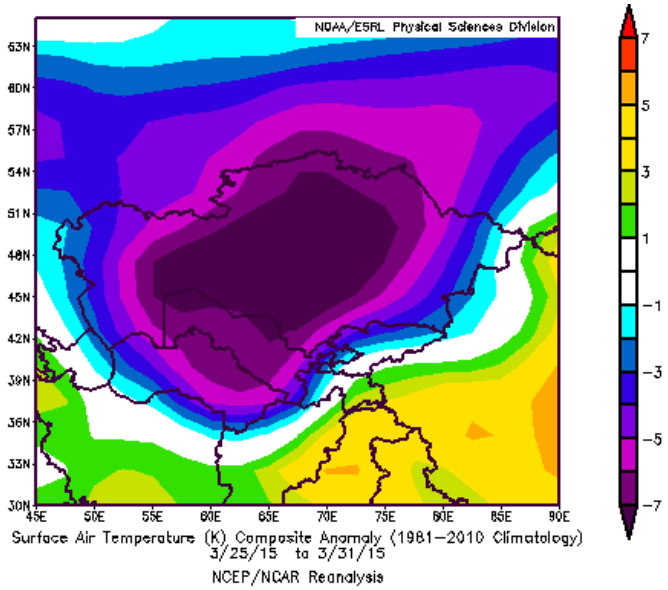


Figure 3: surface air temperature anomaly between the 25/03/2015 and the 31/03/2015 in Kazakhstan. This figure comes from the NCEP/NCAR Reanalysis 1981-2010 Climatology.

Those low temperatures induced a delay of the snow melt and of the start of the vegetation growing period (Figure 4). The observed delay was close to one month on average in the area travelled by the saigas. Consequently, significantly below average values of the vegetation index have been observed in April in this region. The below average biomass period lasted at least 3 weeks and was recovered in May. Unfortunately, it occurred during a critical period: soon after delivering the calves and at the end of the one thousand kilometers migration to the North (Figure 6).

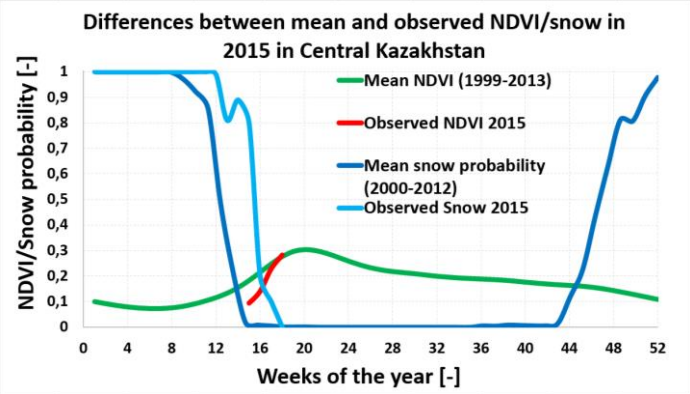


Figure 4: Differences between mean NDVI (Green)/ snow probability (Dark blue) in Central Kazakhstan and observed NDVI (Red)/snow (Light blue) in 2015. Highest NDVI values are found in early May.

Moreover, the climate change and anthropogenic factors are responsible for a shift in the type of vegetation within the main repartition area of the antelopes. The forb vegetation is progressively replaced by gramineous plants. Grass contains less nutrients and this has been shown to have a negative impact on the vitality of the saiga populations (Abaturova et al, 2014)

Figure 5: A dead saiga antelope and its new born (Sergei Khomenko, FAO, May 2015)

According to experts sent by the Convention on the Conservation of Migratory Species of Wild Animals (CMS), the last factor that eventually killed all those saiga antelope is an infection by bacteria from *Pasteurella* or *Clostridium* genus. The high mortality is particularly strange, but could be explained by a weakened immune system.

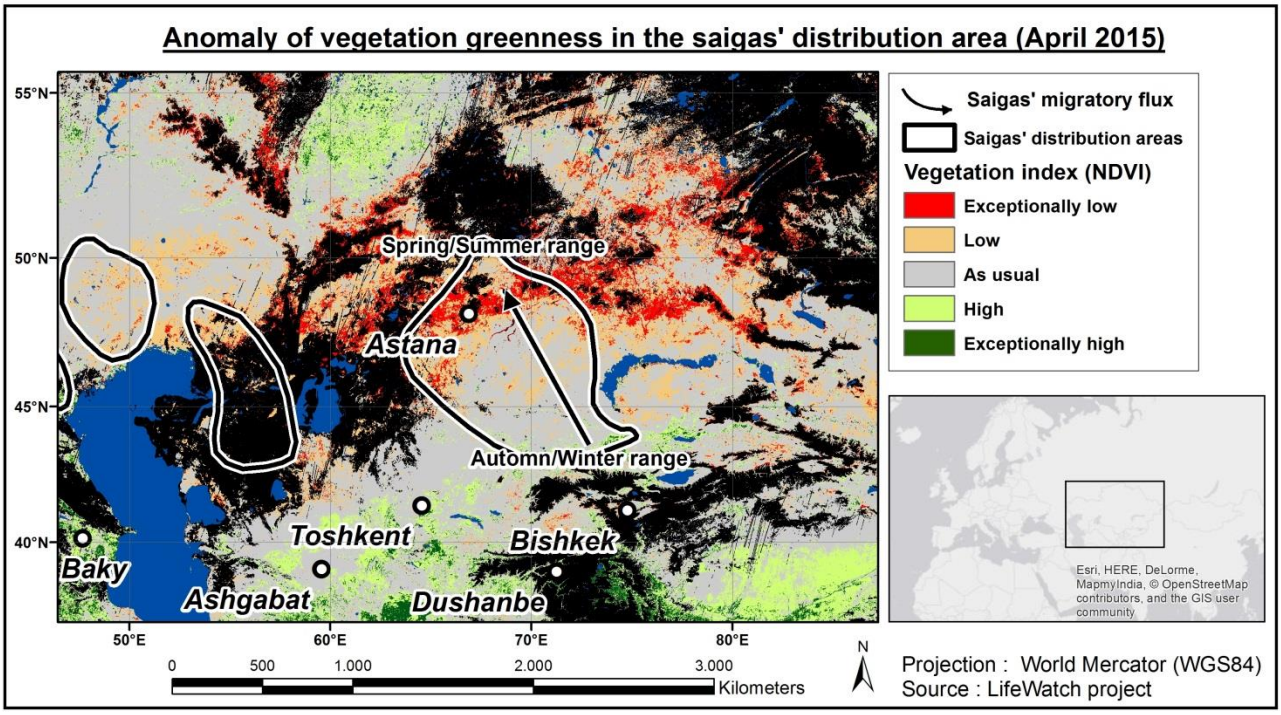


Figure 6: Exceptionally low values of NDVI (in red) in the first three weeks of April 2015 in the Kazakhstan region are observed in the north of the main saigas distribution area (www.iucn.org). According to Morgan et al (2004), saigas spend winter in the south; calve during their northward migration before reaching summer range; migrate back to the south in autumn. The map highlights a large lack of green vegetation at a critical stage of the migration.

Unusual snowfall in Spain this winter

On the first two weeks of February 2015, a large amount of snow fell in the North and North-East of Spain (Figure 7). According to a local newspaper, 550 deers were found dead in the wildlife park of Riano in Leon (located by the yellow dot in Figure 7). Lack of food and clod are supposed to be the cause of this unusual mortality.

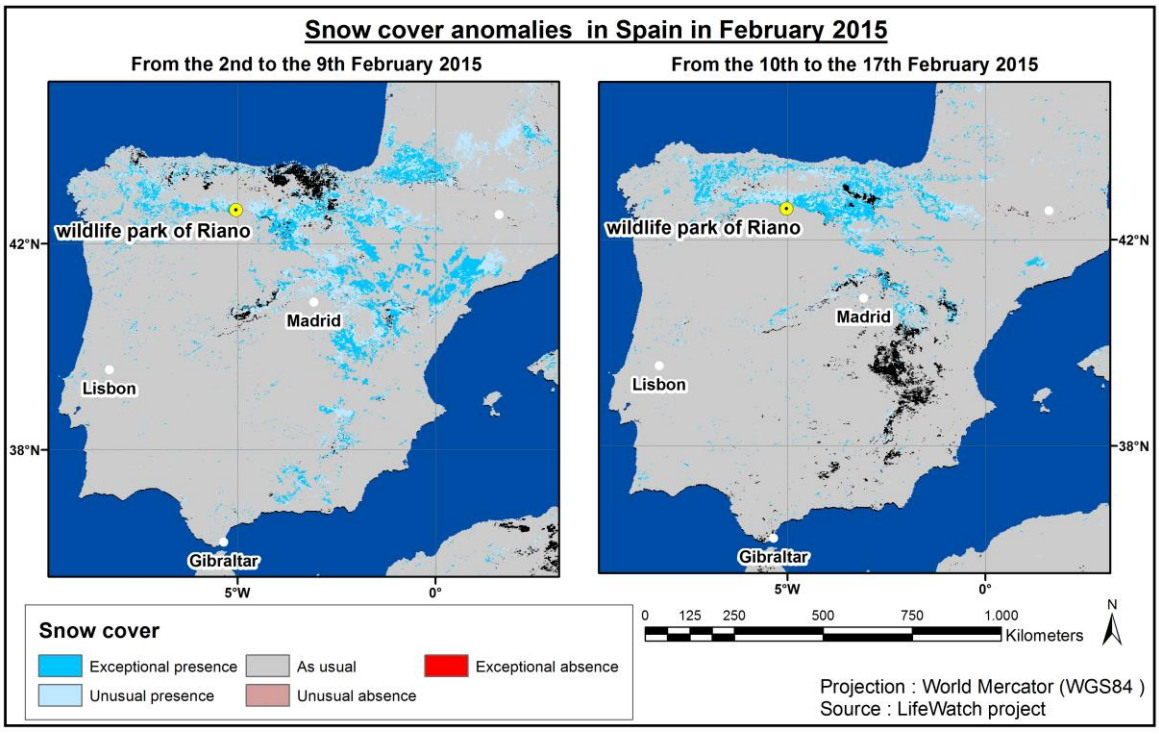
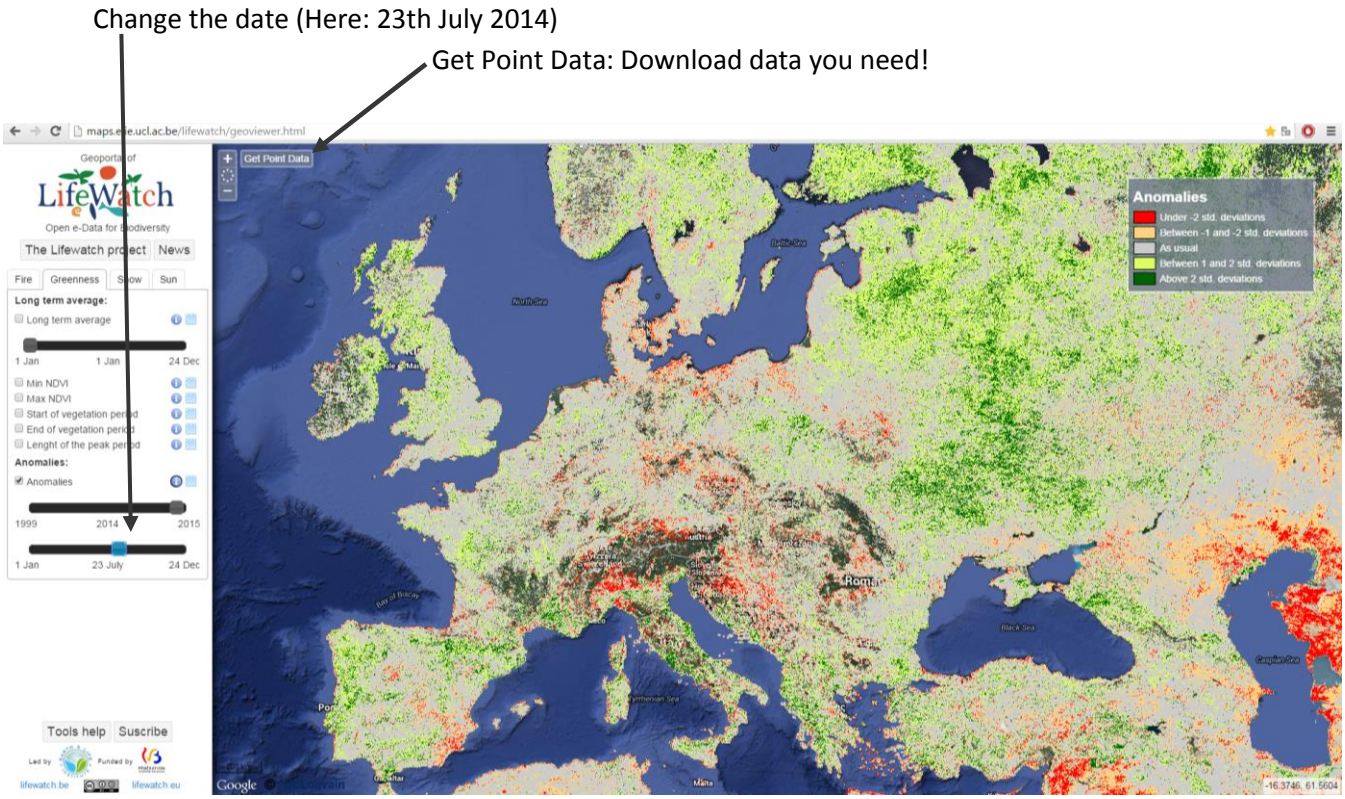


Figure 7: Snow anomalies in Spain during the 2 first weeks of February 2015. Exceptional snow presence are represented in blue.

Web portal to view and download data

All this information (and more) can be visualized from the web portal where a point-based extraction tool is also provided (see below): *www.uclouvain.be/lifewatch*. All data are available at least from 2001 to present and are regularly updated. Follow us on Twitter to get the latest news @LifeWatch_WB. Comments, suggestions or unusual data request are welcome (Lifewatch@uclouvain.be).



LifeWatch: Biodiversity and Ecosystem research

Lifewatch is one of the most ambitious European initiatives for the study of biodiversity and ecosystems. LifeWatch is not a research project, but an infrastructure that offers services and tools to the scientific community, the policy makers and the public. In addition, LifeWatch will provide opportunities to construct personalized 'virtual labs', also allowing entering new data and analytical tools. More information about LifeWatch can be found on: *www.lifewatch.eu*

LifeWatch Wallonia-Brussels is one of the Belgian contributions to the European Research Infrastructure Consortium for Biodiversity and Ecosystem research (LifeWatch). It is funded by the Fédération Wallonie-Bruxelles. Information about the Belgian contributions to LifeWatch can be found on *www.lifewatch.be*

Methods

The summarized land surface dynamics are developed from remote sensing time series of daily global observations by satellites. The times series allow to derive average state of variables at any given time of the year. Data can be compared to this average to highlight anomalies. The average state of variables is developed within the CCI Land Cover project *http://www.esa-landcover-cci.org*. Metrics and anomalies are then derived in the frame of the Lifewatch-WB project. Data from the Belgian satellite Proba-V are used to continue the vegetation greenness time series after the end of SPOT-VEGETATION. Filtered NSIDC maximum extent products are used for snow cover analysis.