Science for policy support work relevant to **Space and Global Health** that is being done at the European Commission's **Joint Research Centre (JRC)** includes the following points:

1. Urban green spaces

Urban green spaces have many functions that can moderate the climate change impact and help prevent diseases and thus alleviate public health expenses in a context of aging societies. The importance of green spaces for health is recognized in the Parma Declaration (WHO 2010) with a commitment *"...to provide each child by 2020 with access to healthy and safe environments and settings of daily life in which they can walk and cycle to kindergartens and schools, and to green spaces in which to play and undertake physical activity*". Similar visions are expressed in the United Nations Sustainable Development Goal 11.7 and the WHO Action Plan for the implementation of the European Strategy for the Prevention and Control of Non communicable Diseases in 2012−2016 (WHO, 2012).

The availability or exposure to green spaces can be assessed from earth observation by calculating the Normalized Difference Vegetation Index (NDVI), which reflects the light-absorbing capacity of vegetation derived from satellite data. The NDVI is a measure of how much live, green vegetation is present in an area and is an indicator of an area's 'greenness' (Pettorelli et al., 2005).

At the JRC, in the framework of the **Global Human Settlement Layer (GHSL)**, changes in the availability of green spaces in the period 1990-2014 were studied considering changes in the NDVI and in the built-up areas across 10,323 Urban Centres around the globe (European Commission, 2018). The Urban Centres were spatially delineated following a harmonized definition of cities and described by a set of thematic attributes, describing the environment, socio-economic characteristics and exposure to natural hazards of the cities, summarized in the Urban Centres Database (Florczyk et al., 2019).

The JRC methodology building on the Urban Centres Database combined with time series of high-resolution NDVI composites allowed conducting in-depth study of the long-term trajectories of urban greenness and showed an overall trend of increased greenness between 1990 and 2014 in most cities. The effect of greening is observed also for most of the 32 world megacities (Corbane et al., 2018).

More information: https://ghsl.jrc.ec.europa.eu/

2. Disaster risks

Disasters are an important aspect of the Space and Health nexus. Disasters cause direct health impacts (mortality, morbidity and psychological trauma) as well as long term impacts (e.g. cholera after floods, respiratory disease are forest fires, cancer after technological accidents). Forecasting disasters and accurately assessing damage are essential in pro-active and reactive disaster management reducing health consequences. Remote sensing and space technology have a long track record in such disaster management processes. The **Copernicus Emergency Management Service** is the result of decades of research and development that has been operationalized in a value-adding processing chain. Its early warning and monitoring component uses space data assimilated in hydromet models or directly (e.g. optical, microwave and thermal data for flood and drought monitoring, and available satellite

sensor data for near-real time wildfire monitoring. The mapping component uses all available sensors to provide rapid damage assessments or risk and recovery products. The **European Flood Awareness System** (EFAS), that is a component of the Copernicus Emergency Management Service, was developed and tested at the JRC.

Equally important for health applications is accuracy mapping of population globally. The **Global Human Settlement Layer** produces new global spatial information, evidence-based analytics and knowledge describing the human presence on the planet.

More information:
- https://emergency.copernicus.eu/
- https://www.efas.eu/
- https://ghsl.jrc.ec.europa.eu/

3. Wildfires

Wildfires pose a serious threat to human populations, producing negative effects on human health and increasing death tolls. The use of remote sensing techniques has become common among forestry and civil protection organisations. Remote sensing permits the near-real time assessment of fire spread, which can be used […] to assess fire effects – including on health – at a very low cost, which complements necessary field campaigns for the in situ assessment of damage and the planning of restoration measures. (San-Miguel-Ayanz et al., 2017)

The **European Forest Fire Information System** (EFFIS) supports the services in charge of the protection of forests against fires in the EU countries and provides the European Commission services and the European Parliament with updated and reliable information on wildland fires in Europe. The JRC implements EFFIS in the context of the Copernicus Emergency Management Service.

More information: http://effis.jrc.ec.europa.eu

4. Waterborne health threats

There are on-going discussions with the **World Health Organisation** on the potential use of the JRC Global Surface Water Explorer (the maps were created from Landsat satellites data) to assess waterborne health threats, for transport process assessment, seasonal stratification, attenuation processes and connectivity mapping/disruptions (for pathogens, pesticide/nutrient runoff, aquaculture, mining, urban contaminants) and ship/road/rail/air traffic contamination of surface water.

5. Impact of environment and climate

The JRC is setting up programmes to link 'health' parameters with environmental/climate/pollution… parameters in order to understand better their relationships. Evidently, space application technology may be an extremely important data source. However, so far we are still exploring the different possibilities and have not yet setup any concrete application. So, there is an interest on our side but nothing concrete yet.