



**Flagship cluster fiche:**  
**THE DANUBE AIR NEXUS (DAN)**

## 1. RATIONALE

Air pollution harms human health and the environment. It is a transboundary, multi-effect environmental problem, which knows no national borders. Air pollutants released in one country may contribute to or result in poor air quality elsewhere.

In parts of the Danube Region, air pollutant concentrations are relatively high and harm health and ecosystems which the Region depends on. In particular, the Danube capital cities Vienna, Bratislava, Belgrade and Budapest and other important harbour cities, show increased pollution of particulate matter and nitrogen oxides. In several other areas of the Danube region, with a high portion of coal and wood burning levels of particulate matter and the carcinogenic compound Benzo(a)pyrene show elevated levels during winter time.

EU legislation, especially including the Air Quality Directive, sets legally binding limits for concentrations of various pollutants. These thresholds are binding on all EU Members States. Danube countries on the path to EU accession are also expected to implement this legislation forming part of the '*acquis communautaire*' and to try to ensure that air pollution remains below the maximum levels before joining the EU.

Air pollution has a direct impact on two of the four vertical priorities of the 'Scientific Support to the Danube Strategy':

- **Environment protection:**  
Air pollution harms ecosystems through various processes: eutrophication on land and water leading to changes in species diversity; acidification which leads to loss of flora and fauna; damage to vegetation resulting from exposure to ozone (O<sub>3</sub>). Several air pollutants are also climate forcers, having a potential impact on the planet's climate and global warming in the short term.
- **Irrigation and agricultural development:**  
Air pollution due to ground-level ozone (O<sub>3</sub>) damages agricultural crops, forest and other plants and leads to agricultural yield losses. The use of nitrogen fertilisers in agriculture is a source of ammonia emissions, which contributes to the formation of airborne particulate matter.

The other two priorities of the 'Scientific Support to the Danube Strategy' are also impacting on air quality:

- **Navigability:**  
Inland waterway transport is an environment-friendly transportation mode. The uptake of sustainable transport technologies by the Inland Water Transport (IWT) market is an important factor for the development of inland navigation's potential with respect to greening of transport. Improving the navigability of the Danube River and its tributaries together with improving the environmental performance of the IWT fleet would help stimulating the use of inland transport in comparison with other more pollutant transportation means and help decreasing air pollution.



- **Energy production:**

Rising energy production and the burning of fossil fuels contribute to air pollution. Energy mix favouring renewable, non-polluting energies would therefore help improving air quality.

Finally, air pollution damages human health through exposure to air pollutants transported and uptaken through the air, or deposited and accumulated in the food chain.

**Related priorities of the JRC Scientific Support to the Danube Strategy initiative:**

Environment protection  
Irrigation and agricultural development  
Energy production  
Navigability and uptake of sustainable transport technologies

**Related priority areas of the EUSDR:**

PA 1A - Mobility – Waterways (coordinated by Austria and Romania)  
PA 02 - Energy (coordinated by Hungary and the Czech Republic)  
PA 06 - Biodiversity, landscapes, quality of air and soils (coordinated by Bavaria and Croatia)

**Policy context and related legislation:**

***EU reference documents:***

[Air Quality Directive](#) (Directive 2008/50/EC on ambient air quality and cleaner air for Europe)

[EU Roadmap for a Resource Efficient Europe](#)

[EU Climate and Energy package](#)

[A resource-efficient Europe – flagship initiative under the Europe 2020 strategy](#)

**International partner organisations:**

UNESCO  
Visegrad Group  
International Commission for the Protection of the Danube River (ICPDR)

## 2. FLAGSHIP CLUSTER DESCRIPTION

The 'Danube Air Nexus' flagship cluster will address the issue of air quality in relation to the four vertical priorities of the Scientific Support to the Danube Strategy (environment protection, navigability, irrigation and agricultural development and energy production), as well as public health.

### **Scope:**

The 'Danube Air Nexus' flagship cluster will cover all countries of the Danube Region. It will deal with air-related issues in the Region and especially, the assessment of air quality sources and the assessment of the impacts of air pollution on health.

### **Flagship cluster structure:**

The following Work Packages are proposed:

#### **◆ Identifying air pollution sources**

The Danube watershed includes one of the air pollution “hot spots” in Europe what makes it an interesting opencast laboratory for scientific studies in this field. From the sources to the outlet, the watershed spreads out through countries with different emissions, due to the different kind of technologies and fuels used and to different level of implementation of the environmental policies. In addition, within each sub-basins are likely to exist gradients from rural–mountainous areas more influenced by sources like biomass burning to flat populated areas more impacted by urban and industrial sources. Also, the impact of ships is expected to vary according to the river navigability.

By selecting a pilot area along the main and subsidiaries watersheds it is possible to evaluate the impact of the implementation of the air quality legislation. Selecting one area within the Danube basin as case study for an intercomparison of source apportionment models could summarise the most urgent air pollution sources and problems.

#### **◆ Scenarios of future air quality emissions**

The Danube basin countries face several challenges related to air pollution:, among which environmental threats (water pollution, floods, climate change) and untapped shipping potential and lack of road and rail transport connections. The Eastern Danube countries are still characterized by high sulfate loads from industries and power generation.

The scenario analysis will be based on the modelling work being performed in the frame of the Low Carbon Economy Roadmap which deals extensively with the consistency and links between energy and processes related to emissions derived from GAINS and other models. This work includes dealing with land use issues (LUMP) and agricultural modelling (CAPRI).

A literature overview and collection of the analysis results from the GAINS model will be made. Air quality emission scenarios for 2020 (and beyond) can be then evaluated, particularly looking at the climate and health benefits. Emissions from inland water transport in the area will be studied and benefits and drawbacks by modal shifts between ship, rail and road transport in scenarios for the future will be assessed.

Specific scenarios of policy options (concerning e.g. regional development and cohesion) will be assessed and their impacts (e.g. on status of regulatory ecosystem services for air quality in urban areas) quantified, following selected environmental, social and economic criteria.

#### ◆ **Climate impact on air quality and health**

Regional climate scenarios will initially be those prepared for the PESETA-II study. They are based on the work of all major regional climate modelling groups in Europe that collaborated in the FP6 ENSEMBLES project. The JRC has “bias-corrected” the output of the ENSEMBLES models, to make them useful for application in climate impact models including impacts on air quality and health. Near the end of 2013, new scenario’s will become available in the international community and will again be bias-corrected by JRC. The use of consistent and up-to-date climate scenario’s will be a strong element in this Work Package.

#### ◆ **Assessing impacts of PAH on health**

Establishing causal links between specific environmental exposures and complex, multi-factorial health outcomes is difficult and challenging, particularly in children. Exposure can occur in utero through trans-placental transfer of environmental agents from the mother to the foetus or in nursing infants via mother's milk. Some adverse outcomes of exposure have been shown to be irreversible and persist throughout life. In order to gain a better understanding, further research is needed in areas like designing and implementation of prospective cohort studies of pregnant women, infants, and children with longitudinal capture of exposures at critical windows and sensitive health end-points along the continuum of human development., as well as development and validation of sensitive, and cost-effective biomarkers of exposure, susceptibility, and effects, particularly during early developmental stages.

The Work Package will assess the impact of atmospheric carcinogenic/genotoxic PAHs (Polycyclic aromatic hydrocarbons) on child development and the role of global gene expression changes in this process, focusing on pathways affecting immunity. Blood samples from pregnant women and umbilical cords at the delivery will be collected in the Department of Obstetrics and Department of Neonatology of Hospitals in the Danube area and a whole genome analysis will be carried out to identify gene profiles that could be used as biomarker of exposure to c-PAHs, as well as to investigate gene pathways affected by the exposure to c-PAHs during pregnancy.

These activities could benefit from data made available through the Danube Reference Data and Services Infrastructure (DRDSI) and at the same time will contribute to populate the DRDSI with the additional datasets collected and/or generated. All new data will be properly documented in order to facilitate their re-use. The access to the data will be governed by rules and procedures defined for the DRSDI.

### 3. OUTPUTS AND BENEFICIARIES

#### **Products:**

- Identification of air pollution sources
- Future emission scenarios for air pollutants
- Evaluation of impacts of atmospheric Polycyclic Aromatic Hydrocarbons on child development

#### **Potentially interested actors and/or beneficiaries of the research results:**

EU institutions and bodies

National and regional governments of the Danube Region

Other stakeholders of the Danube Region

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