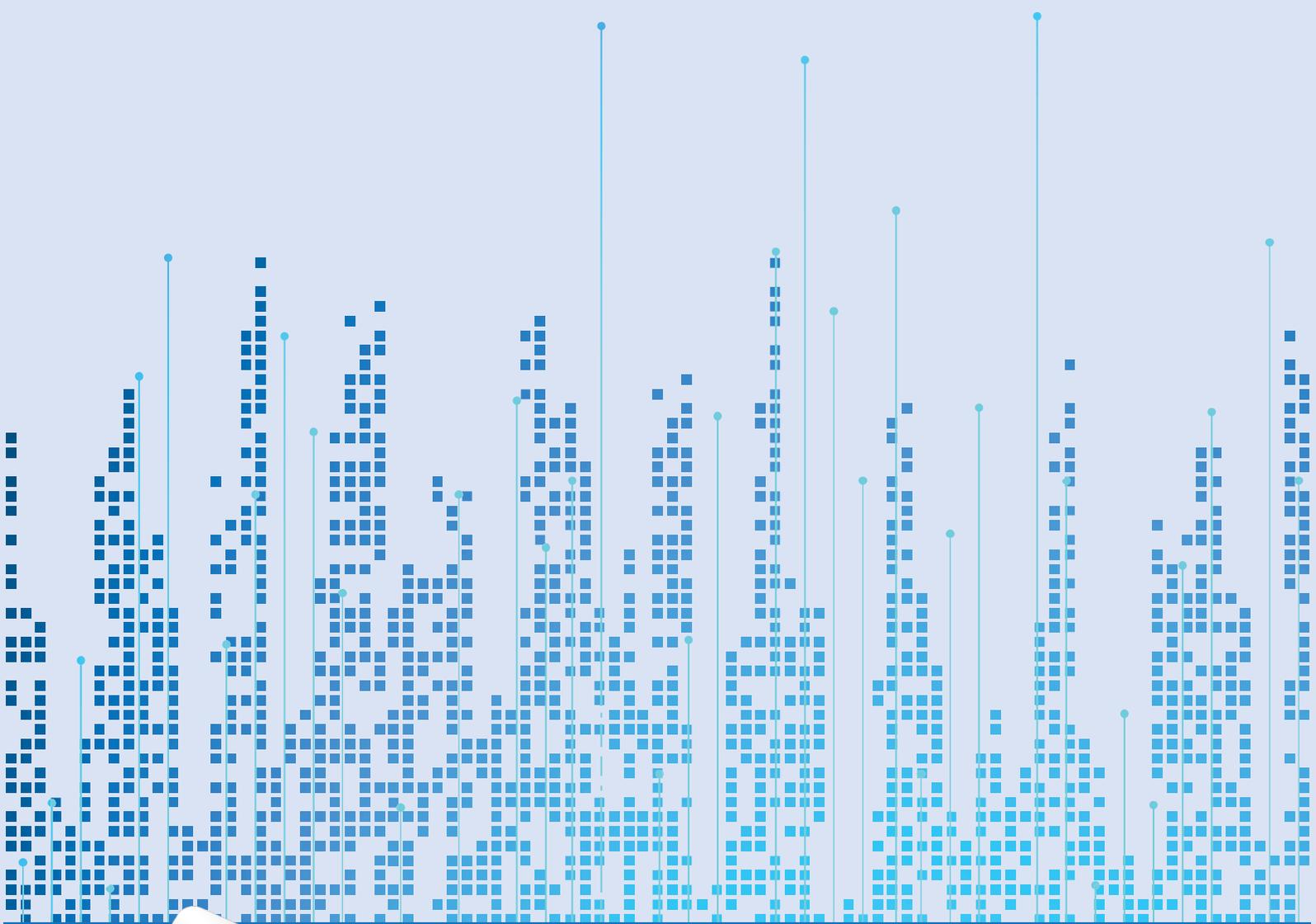


National Development Strategy Croatia 2030 Policy Note:

Environment

July 2019



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Note

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1 Overview of the global trends and societal challenges

Environmental policies are an integral component of policy frameworks in every country. Although they differ from one country to another, the central environmental policy themes of many countries largely rest on three pillars:

- a. Leveraging natural capital¹;
 1. Promoting a resource-efficient and low-carbon growth;
 2. Safeguarding against environmental and climate change risks.

The note follows, and arranges its analysis largely around, these three pillars.

1.1 Global perspective

1.1.1 Natural Capital

The sustainable management of natural capital is vital for economic growth and human wellbeing.

When managed well, renewable natural resources (forests, fisheries, etc.), watersheds, productive landscapes and seascapes can provide the foundation for sustained inclusive growth, food security and poverty reduction. Globally, the livelihoods of hundreds of millions of people depend on terrestrial and coastal ecosystems such as agricultural soil and forests productivity, as well as ocean fisheries and aquaculture. Healthy ecosystems are essential for the long-term growth of economic sectors such as agriculture, forestry, fisheries and tourism. They provide hundreds of millions of jobs and generate sizeable tax revenues. The world's ecosystems regulate the air, water and soil on which we all depend, and form a unique and cost-effective buffer against extreme weather events and climate change. One third of the world's 100 largest cities draws their water supply from protected areas. Three quarters of the world's top 115 food crops depend on animal pollination.

The integrity and functionality of natural capital are increasingly compromised, with 60% to 70% of the world's ecosystems degrading faster than they can recover, thereby reducing economic growth and human wellbeing. The degradation of ecosystems and the services they provide leads to the emergence of disease, collapse of fisheries, depletion of soil and forest products, shifts in regional climate and a loss of biodiversity. Over the past 40 years, there has been a significant depletion of healthy ecosystems (such as forests, mangroves, sea grass beds, coral reefs) and their flora and fauna populations, with the resulting species loss affecting everything from fungi to insects, plants, frogs, tigers, and gorillas. The loss of biodiversity and degradation of natural capital results in significant economic losses. For instance, an estimated EUR 70 billion are squandered each year due to the mismanagement of ocean fisheries (90% of global marine fisheries are fully fished and overfished).

Natural capital accounting is an element of wealth accounting that assesses a “smart GDP”, which has already been practiced in a dozen of countries. The current method of GDP assessment does not reflect the depletion or enhancement of natural capital. GDP does not measure: the loss of

¹ Natural capital refers to ecosystems that provide essential goods and services that underpin economic activity, from fertile soil and multi-functional forests to productive land and seas, from good quality fresh water and clean air to pollination and climate regulation and protection against natural disasters. As such natural capital can be leveraged for economic growth, and its sustainable use underpins sustainable development.

natural areas that provide ecosystem services to the economy, such as pollination; the extent to which renewable resources like forests and fisheries are being depleted; the depletion of minerals and mineral fuels; future losses resulting from greenhouse gas emissions (such as the rise of sea levels, extreme weather conditions, and agricultural losses); and the possible future economic losses resulting from pollution leading to premature deaths and chronic diseases. Many of nature's vital services are often "invisible" to people. These include air and water filtration, flood protection, carbon storage, pollination for crops, and the provision of a habitat for fisheries and wildlife. These values are not readily captured in markets, so their contribution to the economy and to livelihoods is not recorded. Ecosystem services are taken for granted and countries do not know what it would cost the economy if these services were lost. In forestry, for example, timber resources are counted, but forest carbon sequestration is not. Other forest services, such as water regulation that benefits crop irrigation, are hidden and the value is attributed to agriculture in a country's GDP. The value of ecosystem services is very difficult to assess in monetary terms but the current estimates suggest that, globally, ecosystem services contribute more than twice as much as global GDP to human well-being.

1.1.2 Resource-efficient and low carbon economy, green living

Halting and adapting to climate change, as well as shifting to a low-carbon economy are some of the key challenges of our time. Countries and communities around the world are already experiencing increased climate change impacts (including droughts, floods, more intense and frequent natural disasters, and rising sea-levels) and the poorest and most vulnerable groups are being hit the hardest. With each passing year, the risks of unabated climate change are mounting. Without urgent action, climate impacts could push an additional 100 million people into poverty by 2030. The impact of extreme natural disasters is equivalent to a global loss in annual consumption of EUR 450 billion and forces some 26 million people into poverty each year. Climate change is already having real and measurable impacts on human health, and these are expected to grow. Climate change will not only make it more difficult to feed the projected 10 billion people populating this world by 2050 but its impact is already being felt in the form of reduced yields and more frequent extreme weather events affecting crops and livestock. Under the Paris Agreement, the world committed to limiting the increase in global temperatures to below 2°C above pre-industrial levels by the end of the century. But the world is not on track to achieving this target. Major adaptation efforts are inevitable. While accelerating adaptation/resilience to manage the inevitable, more aggressive mitigation is needed to keep the inevitable manageable. Mitigation efforts must go beyond reducing GHG emissions and aim to enhance biological carbon sequestration via the management/use of forests, land, soil and oceans. Policies promoting climate change mitigation measures and a shift to a low-carbon economy offer opportunities to boost innovation, jobs and sustained economic growth.

Clean, green and resilient growth is critical to achieving global poverty reduction and development in an increasingly fragile environment. Many governments, businesses and civil society organizations have started to gear their policies and practices towards the sustainable management and conservation of natural resources that improve livelihoods and ensure food security. They strive towards low-pollution, low-emission solutions for cleaner air, water, and oceans, so as to enable people to lead healthy, productive lives, and resilience strategies preparing for weather shocks and effective adaptation to climate change. Obstacles to greening growth include political and behavioural inertia, institutional fragmentation and a lack of financing instruments. Informed decision-making based on analysis that acknowledges the value of natural resources can lead to strategic investments and farsighted policy changes which would result in an efficient, clean, green and resilient growth.

1.1.3 Safeguard against environmental and climate change risks

Environmental pollution damages humans' and ecosystems' health. Air pollution is now the fourth leading risk factor for premature deaths, contributing to 1 in 10 deaths worldwide and resulting in significant losses of welfare and income. Pollution of freshwater is a risk to the supply of potable water, while the creation of “dead zones” in coastal waters negatively impacts fisheries and aquaculture. Marine pollution from chemicals, waste and notably microplastics has become a serious global issue. Microplastics harm marine organisms and end up in people's food, posing a risk to the environment and potentially public health. Extreme weather events related to climate change are also changing the distribution of disease vectors and having a negative impact on health. Therefore, policies to protect the environment – be it clean air or clean water or well-functioning waste management systems– and reduce the climate change impacts improve health and the quality of life of citizens.

1.2 An EU perspective

The EU is fully committed to implementing the 2030 Agenda and the Sustainable Development Goals (SDGs)¹, and sustainable development is therefore at the core of the EU vision. EU policies, initiatives and long-term visions include sustainable development as a key guiding principle. For example, the EU water policy addresses the need to protect inland surface waters, transitional waters, coastal waters and groundwater. It relies on legislation on drinking water, bathing water and urban wastewater, as well as on the prevention of pollution caused by nitrates, industrial emissions, pesticides and persistent organic pollutants. The Energy Union strategy pursues energy security and efficiency. Following the 2020 energy and climate package, the EU has set further targets: the 2030 climate and energy framework foresees a 40% reduction of greenhouse gas emissions, at least 27% renewables share in the EU's energy mix, and an increase of at least 27% in energy efficiency. The EU promotes sustainable urbanization. More than EUR 100 billion is being invested up to 2020 to support urban mobility, energy efficiency, urban renewal, research and innovation capacity, and the regeneration of deprived communities.

Within the EU, environment is seen as integral to economic development. The EU's Environment programs set goals not just to achieve environmental outcomes but also to support sustainable economic growth. The 7th Environment Action Programme, the long-term strategy of the EU on environment, has three broad objectives that are intertwined with economic development goals: (i) to protect, conserve, and enhance natural capital; (ii) to promote a resource-efficient, green, and competitive low-carbon economy; and (iii) to safeguard against environment-related risks to health and wellbeing. Two other objectives, making cities more sustainable and committing to international environmental issues (including climate change), also contribute to sustainable economic development. The 7th Environment Action Programme also includes actionable measures that are in line with the SDGs.

1.2.1 Protect, Conserve and Enhance Natural Capital

Protecting natural capital is the EU's first environmental priority objective. The EU has made progress in preserving and sustainably using its natural capital. The 2018 Environmental indicator report suggests that the EU has achieved positive or stable trends on most indicators, except for 3 indicators related to biodiversity (**Table 1**). However, even with these positive trends, meeting 2020 targets would require even more pro-active policies and bolder actions.

Table 1. The progress in preserving and sustainably using natural capital in Europe (Source: EEA, 2018²)

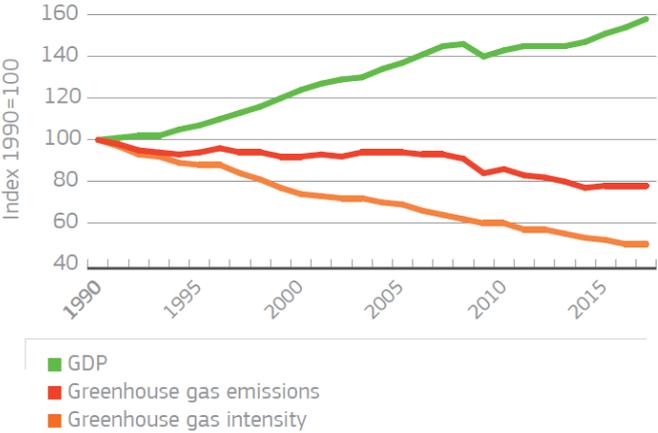
Indicator	EU indicator past trend (*)
Priority objective 1: 'to protect, conserve and enhance the Union's natural capital'	
(!) Exposure of terrestrial ecosystems to eutrophication due to air pollution (*)	▲
Gross nutrient balance in agricultural land: nitrogen	▲
(!) Land take (*)	▲
(!) Forest: growing stock, increment and fellings	▲
Status of marine fish and shellfish in European seas	▲
Abundance and distribution of selected species (common birds (*) and grassland butterflies)	▲
(!) Species of European interest	▲
(!) Habitats of European interest	▲
Status of surface waters	▲

1.2.2 Promote a resource-efficient and low carbon economy

The push towards a resource-efficient and low carbon economy stems from the recognition that the current resource use patterns are not sustainable. Resources that are critical for sustained production and consumption – minerals, water, etc. – are becoming scarcer and the use of some of these resources is creating harmful impacts – waste at the local level and greenhouse gas emissions at a global level. Moreover, and relatedly, the benefits of switching to the circular "reduce-reuse-recycle" model – the circular economy – that promotes resource efficiency, can be tremendous. It is estimated, for example, that across the EU 3.4 million people are currently employed in the circular economy, including in the repair, waste, recycling and rental. Moreover, the expansion of the circular economy is projected to potentially create 3 million extra jobs and reduce unemployment by 520,000 across EU member states by 2030³.

EU MS have made progress towards decoupling greenhouse gas emissions from economic growth and improving resource use efficiency (**Figure 1**). Still, additional efforts and continued EU leadership are required to keep the planet under the 1.5-2°C warming goal and achieving a fully circular economy.

Figure 1. EU demonstrates that economic growth and low-carbon transition are compatible (Source: EC, 2019¹)



Three out of four Europeans (75 percent) now live in urban areas and this is expected to rise to 80 percent by 2050. Cities are a key contributor to climate change, as urban activities are a major sources of greenhouse gas emissions. Estimates suggest that cities are responsible for 75% of global CO₂ emissions, with transport and buildings being among the largest contributors. Cities hold the key to ecological sustainability; the EU’s environmental commitments and the Paris climate goals can only be achieved with their active contribution. Cities are starting to make a transition to environmental sustainability. Amsterdam is the first city in the world to adopt a circular economy action plan. The city of Copenhagen has developed the first carbon neutral district; Milan has opened the biggest bicycle sharing facilities in Europe and Stockholm is committed to be fossil fuel free by 2040. Such actions must continue and will need to be scaled up to support sustainable development.

1.2.3 Safeguard against environmental and climate change risks

Addressing environmental and climate change risks will help improve the quality of life of EU members. For example, although, the EU has been working for decades to improve air quality by controlling the emissions of harmful pollutants, improving fuel quality, and integrating environmental protection requirements into the transport, industrial and energy sectors, and concomitantly, member states have successfully reduced emissions of pollutants by 40 to 80% since 1990 (**Figure 2**), air pollution remains a major cause of premature deaths and disease and is the single largest environmental health risk in Europe, causing around 325,000 premature deaths per year (**Table 2**). Efforts to tackle air pollution will result in better lives for citizens. Similarly, while water availability has generally improved across the EU, pollution, scarcity and climate impacts such as heavier flooding, need to be addressed.

Figure 2. Emission of air pollutants in Europe since 1990–2016 (Index 1990 = 100 and 2000 = 100) (Source: UNECE: 20184)

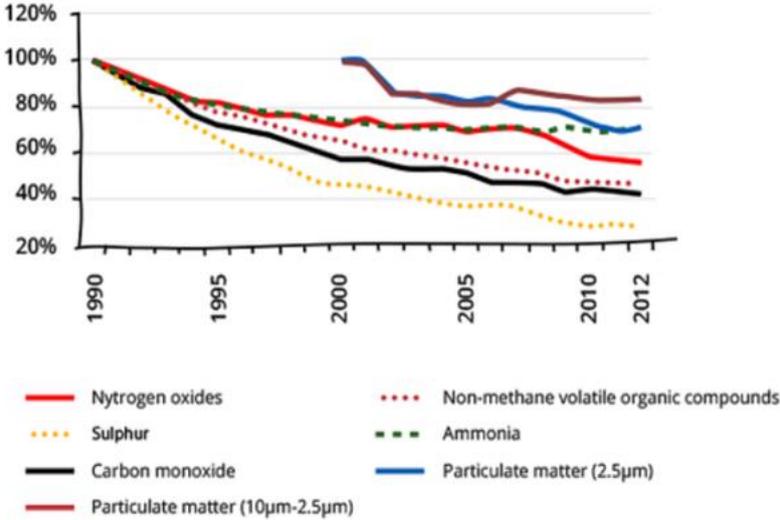


Table 2. EU-28: estimated number of premature deaths and years of life lost attributable to PM_{2.5} (from a concentration of 2.5 µg/m³) and NO₂ (from a concentration of 10 µg/m³) in 2015 (Source: EEA, 2018⁵)

	PM _{2.5}	NO ₂
Concentration (µg/m ³)	2.5	10
Premature deaths	325 000	228 000
Years of life lost	3 444 000	2 385 000

Environmental and climate change risks, when unmanaged, are also costly to the economy. If areas of cultural significance or natural landscapes that could serve as tourism destinations, are polluted, they are less likely to draw visitors and generate (tourism) revenues. They will also provide fewer ecosystem services and reduce the livelihood of the local communities. Air pollution is estimated to reduce agricultural productivity and cause forest degradation. Similarly, water scarcity can hamper agricultural production, hydropower generation, and tourism. Climate change impacts, particularly in relation to extreme events, can result in the loss of assets.

2 Overview of developments in Croatia

Croatia is a country rich in natural resources, with a splendid coastline, vast forests and natural landscapes, and abundant water resources. 47 percent of Croatia's land is classified as forests and another 32 percent as pastures and mosaics⁶, making Croatia exceptionally rich in terms of landscape and biological diversity. If sustainably managed, this vast natural wealth can form the basis of a green and prosperous Croatia, giving Croatia the opportunity to brand itself as “Green Croatia”, a country with an unspoiled environment and beautiful nature. In order to successfully attain this status, Croatia will need to improve its resource efficiency and tackle a number of environmental challenges. Urban areas in Croatia lag behind comparator EU cities in, for example, the provision of green spaces and efforts to tackle pollution. Climate change also looms high among the prevalent environmental issues: while Croatia has a relatively small carbon footprint, it is one of the countries that is most vulnerable to climate change among the EU MS.

The rest of this section looks at how well Croatia is performing on the three pillars of a green growth strategy – leveraging natural capital, resource-efficient and low-carbon growth, and safeguarding against environmental and climate change risks – to take stock of how ‘Green’ Croatia is today.

2.1 Is natural capital contributing to economic growth?²

Croatia has a vast network of protected areas, with 37 percent of its land designated under the Natura 2000 network. With 8.6 percent of the land and the territorial sea area protected under the Nature Protection Act⁷ and a much larger percentage, 37 percent, designated under Natura 2000 – an ecological network of the European Union consisting of the most significant areas to be safeguarded for the conservation of species and habitat types – Croatia has a vast network of protected areas. Among the EU MS, Croatia is second only to Slovenia in terms of the percentage of total land covered by the Natura 2000 network⁸. By 2015, Croatia had designated 743 Sites of Community Interest (SCIs)³ under the Habitats Directive and 38 Special Protection Areas (SPAs)⁴ under the Birds Directive. Additionally, Croatian Natura 2000 sites include significant marine areas hosting some 7,000-8,000 marine species, including substantial resident populations of bottlenose dolphins and one of the two most important feeding and wintering grounds for the loggerhead turtle in the Mediterranean⁹.

Tourism is the backbone of the Croatian economy, and nature – coastal areas as well as Natura 2000 sites – is the foundation of Croatia's tourism offerings. According to the EC Economic Directorate¹⁰, in 2016, foreign tourists spent 45.5 billion euros in Croatia, which is almost 20 percent of the country's GDP and is more than 35 percent of its export revenues. Furthermore, according to the World Economic Forum's Travel and Trade Competitiveness Index¹¹, which ranks 136 countries along four broad parameters -- enabling environment (in blue, Figure 3), travel and tourism policies and enabling conditions (in purple), infrastructure (in orange), and reasons for travel (in red) -- Croatia ranked 32nd in terms of its tourism performance. Moreover, with a global ranking of 20th, Croatia's natural

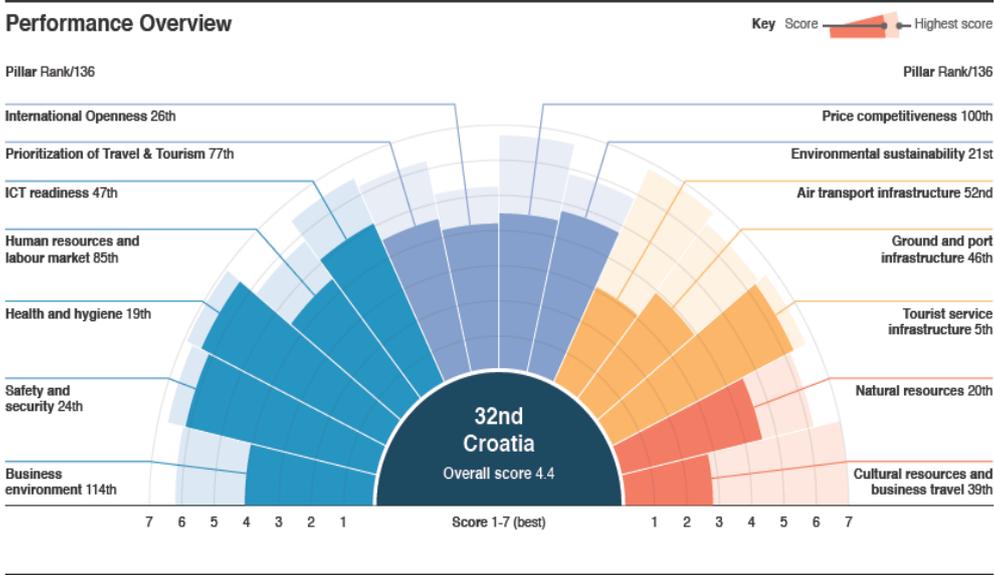
² This Note only deals with a small aspect of natural capital – protected areas and water – as there are separate notes for forests, agricultural lands, and fisheries.

³ These are created to conserve 233 habitat types and 900 plus species in the EU.

⁴ These are created for protection of 194 particularly threatened bird species and all migratory birds in the EU.

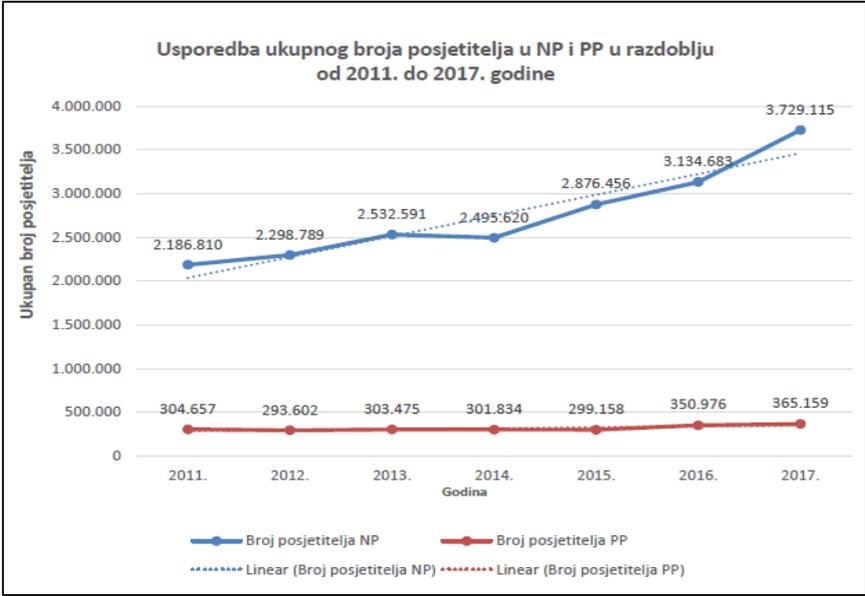
resources are what draws tourists to the country (Figure 3). Additionally, a recent EU survey identified the quality of natural features and landscapes, especially in coastal areas (all features that Croatia has in abundance) as the main factors affecting tourists' choice of holiday destinations.¹²

Figure 3: Index of Travel and Tourism Competitiveness in Croatia (Source: WEF, 2017¹¹)



In 2017 national and nature parks received more than 4 million visitors - every third visitor to Croatia visited a national park. More than 3 million people visited the Plitvice Lakes and Krka National Parks. The number of visitors is growing; in just six years (2011-2017), the number of visitors to national parks rose by almost 80 percent (Figure 4).

Figure 4. Number of visitors to national and nature parks in Croatia (Source: Kreitmeyer, 2018¹³)

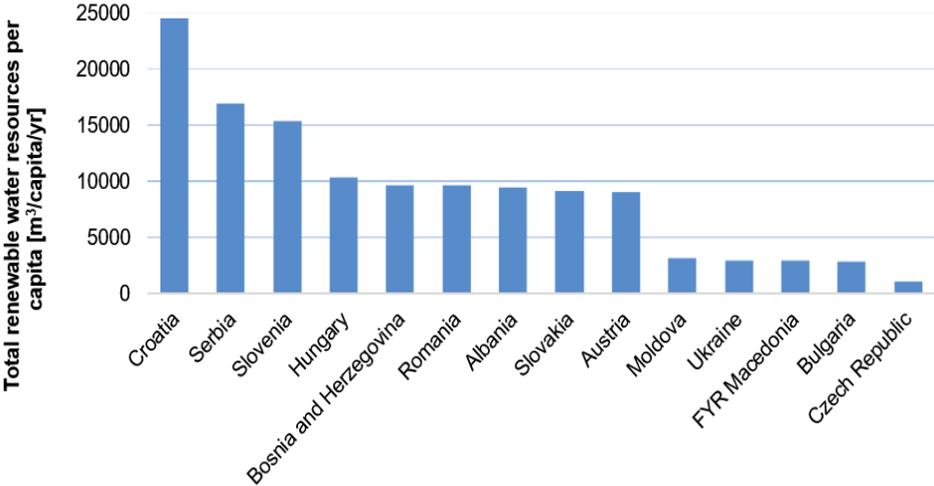


Natura 2000 sites also yield a range of ecosystem services that benefit the economy. A range of sectors – agriculture, forests, fisheries, energy – benefit from the ecosystem services derived from Natura 2000 landscapes. Pollination services that are critical to the agriculture and forestry sector are

generated from natural habitats for bees, forested landscapes and grasslands retain soil and filter pollutants to improve the quality of water to the benefit of people but also hydropower plants, for example.

Croatia is water abundant. Despite seasonal and regional disparities, Croatia is a water-rich country (Figure 5). For most of the year, the water quantity in Croatia is not a restricting factor. Households consume a vast majority of the water, while economic activities account for only a quarter of all water used in Croatia¹⁴.

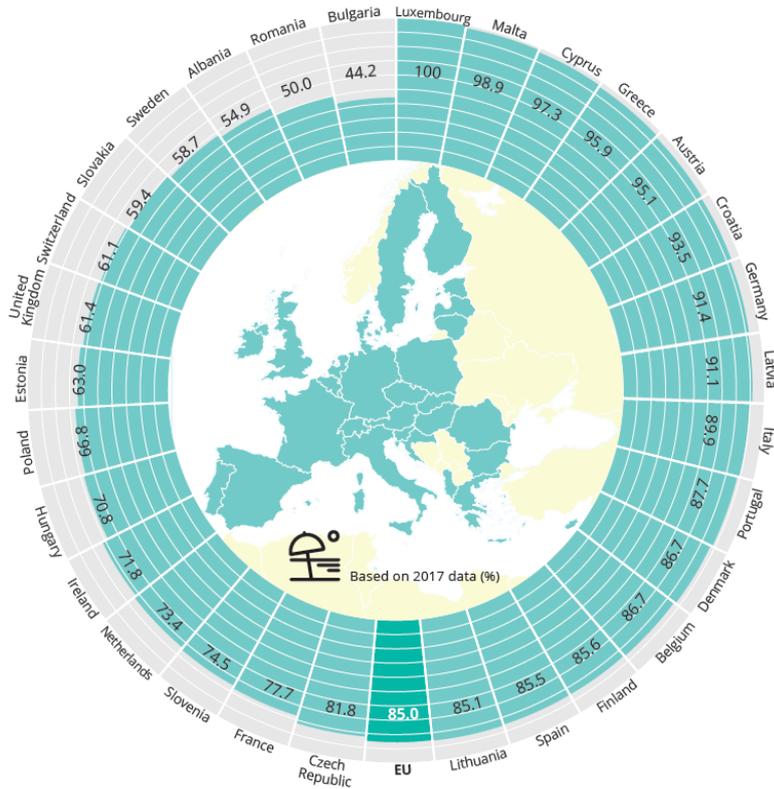
Figure 5. Quantity of renewable water resources in selected European countries (Source: WB, 2015¹⁵)



Access to quality drinking water is high, though the extent to which land is irrigated is low. As much as 84 percent of the population has access to the public water supply system and drinking water is of high quality¹⁴. However, Croatia has one of the lowest ratios of irrigated-to-irrigable land in the region: only 22,500 ha are currently irrigated out of 484,026 irrigable ha¹⁶.

Croatia’s bathing waters are of excellent quality, which benefits tourism. Croatia has managed to preserve, protect, and improve the quality of the environment at designated bathing water sites to protect human health and boost tourism. In 2017, 93.5 percent of the 976 bathing waters sites in Croatia were assessed as being of excellent quality¹⁷, ranking Croatia as the sixth best among 30 European countries for which bathing water quality is being assessed according to the EU Bathing Water Directive (Figure 6). As many as 97 percent of designated bathing sites are at coastal locations, where most of the tourism is concentrated.

Figure 6. Proportion of bathing water sites with excellent water quality in 30 European countries (Source: EC, 2018¹⁸)

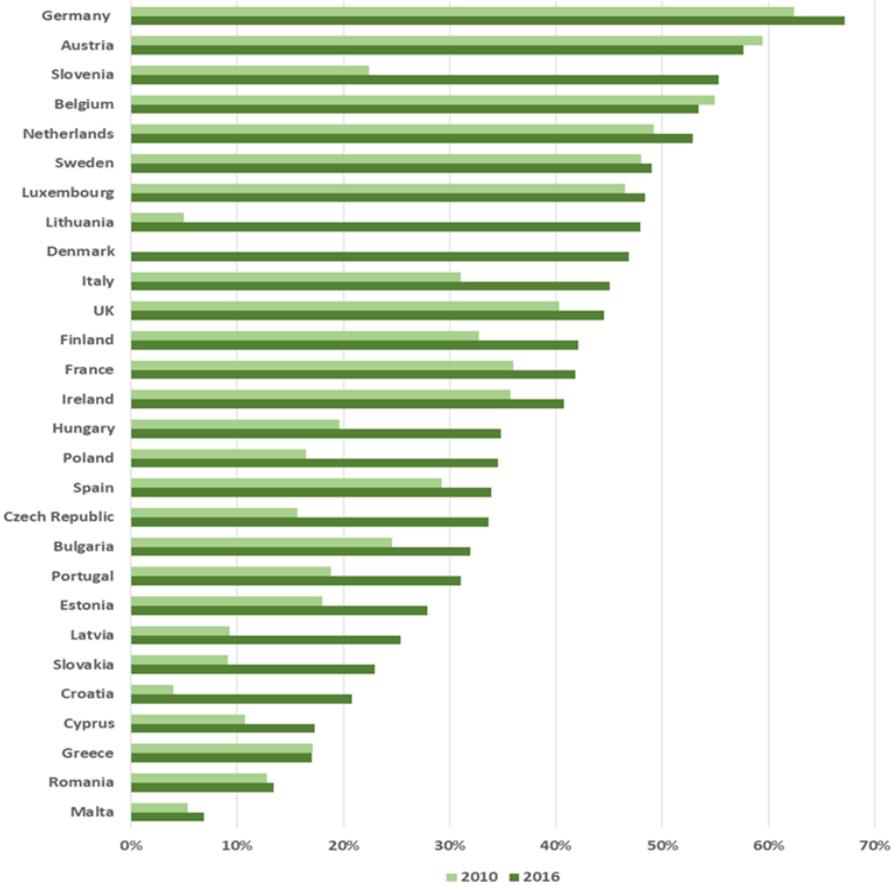


To summarize, **natural capital is already an integral part of Croatia’s growth strategy and is contributing to economic growth.** However, as argued in section 3, there is the potential to further enhance natural capital’s contributions to economic growth

2.2 Is the economy resource-efficient and low-carbon? Are cities livable?

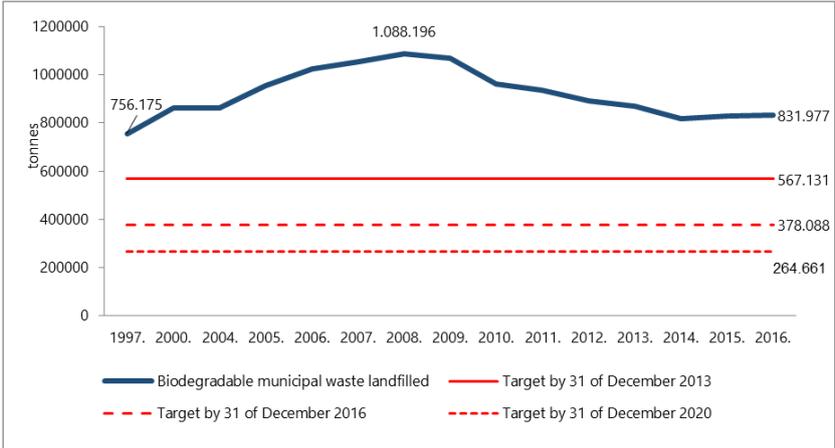
Insufficient waste management practices risk harming the country’s image and economy. The coverage of the population by organized collection of municipal waste is very high in Croatia: 99 percent of the population has access. Croatia is, however, far from reaching its key waste management targets, which include to separate collection, and promote recycling of waste, the reduction in landfilling of biodegradable waste, the closure of all non-compliant landfills by the end of 2018, and the construction of regional waste management centers (WMCs). In 2016, only 21 percent of the waste was being recycled compared to the EU average of 47 percent (Figure 7), implying poor separate collection (26 percent). Croatia missed its 2013 and 2016 targets for the quantity of biodegradable waste that could be deposited in landfills; the current quantity deposited is three times the target set for 2020, making it likely that the 2020 target will also be missed (Figure 8). Moreover, with only two WMC compliant with EU-standards having been constructed and made operational, the major fraction of waste is being deposited on approximately 100 non-sanitary landfills. In 2016, the rate of municipal waste landfilling was 77 percent (compared to an EU average of 24 percent), making it among the highest in the EU.

Figure 7. Country comparison – Municipal waste recycled and composted in EU (Source: EEA, 2018¹⁹)



Given that Croatia failed to bring its landfills into compliance by the end of 2018 and that EU goals for recycling 50 percent of separated municipal waste by 2020 are unlikely to be met, as are the targets for landfilling of biodegradable waste (**Figure 8**), the country risks the EC beginning an infringement procedure. Lack of adequate waste management can also harm the development of the tourism sector, particularly its high-end segment. Additionally, poor waste management can lead to health risks, such as from leachate penetrating the groundwater.

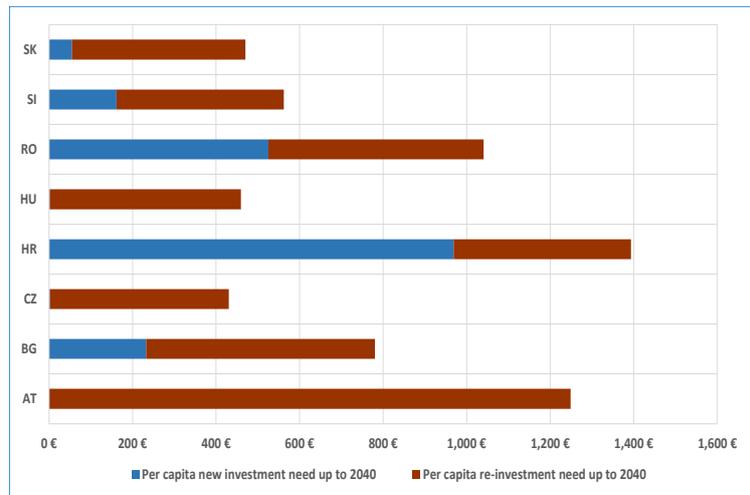
Figure 8. The targets and amounts of biodegradable waste landfilled (Source: HAOP, 2017²⁰)



Drinking water is not being used efficiently and is being wasted due to the inefficient provision of public services, contributing to significant economic losses. Though access to quality drinking water is good, due to various reasons (mainly economic), only about 86 percent of the population is connected to the public water supply system and the rest are supplied by local suppliers, with large variations in reachability between different regions. Losses in the public water supply system are still significant – approximately 49 percent, which is much higher than in most other EU countries. The monetary value of the drinking water wasted due to leakages in pipes in 2007 is estimated to be circa 286 million EUR (0.9 percent of GDP)²¹.

There have been delays in achieving compliance with the Urban Waste Water Treatment Directive. With only 56 percent of the population connected to public sewage systems, and 38 percent with access to adequate levels of wastewater treatment, the country is trailing behind all other EU states. The development and maintenance of adequate wastewater collection, treatment and disposal systems in the environmentally sensitive Adriatic coastal zone is a precondition to support a thriving tourism section in Croatia’s coastal area. The transitional period for the fulfilment of the Urban Waste Water Treatment Directive (UWWTD) requirements ends in 2023. Croatia has made some progress: in comparison to 2008, the total number of UWWT (urban wastewater treatment) plants has increased, largely due to the IFI and EU financed investments, leading to an increase in the percentage of the population that is connected to secondary level wastewater treatment from 22 to 38 percent. However, Croatia will have to work hard to achieve the UWWTD’s objectives and comply with its requirements on time. Croatia is estimated to require the highest per capita investment needed for UWWTD compliance among all Danube Basin MS (Figure 9). The EU funds are likely to cover about 70% of investments needed, indicating the existence of a considerable financial gap. Tariffs are therefore expected to continue rising in the future to help cover the difference. But tariff increases may trigger affordability issues for poorer segments of the population.

Figure 9. Future Per Capita Investments needed for UWWTD compliance to 2040 in Danube basin states Reference Year 2015 (Source: Umweltbundesamt et al. 2017)



GHG emissions have steadily decreased in Croatia, and Croatia is well on track to meet the EU’s reduction targets. In the period 2005-2015, Croatia decreased its GHG emissions by 19 percent and is expected to decrease them further, to 25 percent below 1990 levels, by 2020. Croatia will thereby easily comply with the common EU goal. Croatia is also expected to meet its greenhouse gas emission reduction target for the period 2020-2030 under business as usual scenario, without any additional policy measures. Croatia’s vast forests act as a sink of CO₂, sequestering an average of 10.4 t CO₂-eq/yr in the period 1990-2014. This represents an offset of 65% of Croatia’s total greenhouse gas emissions over the same period²².

Furthermore, Croatia’s per capita emissions of GHG are among the lowest in the EU. In 2015, Croatia had the lowest GHG emissions per capita in the EU (Figure 10). While no longer the lowest in the EU, per capita emissions still remain relatively, low: in 2016, Croatia had the seventh lowest emission on a per capita basis (Figure 11).

Figure 10. GHG emissions per capita in 2015 (Source: EEA, 2017²³)

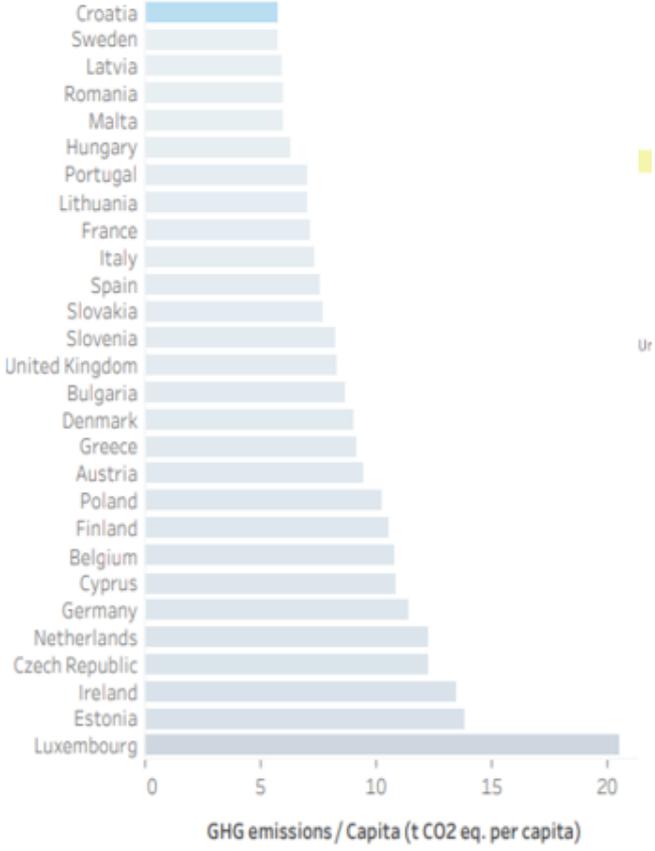
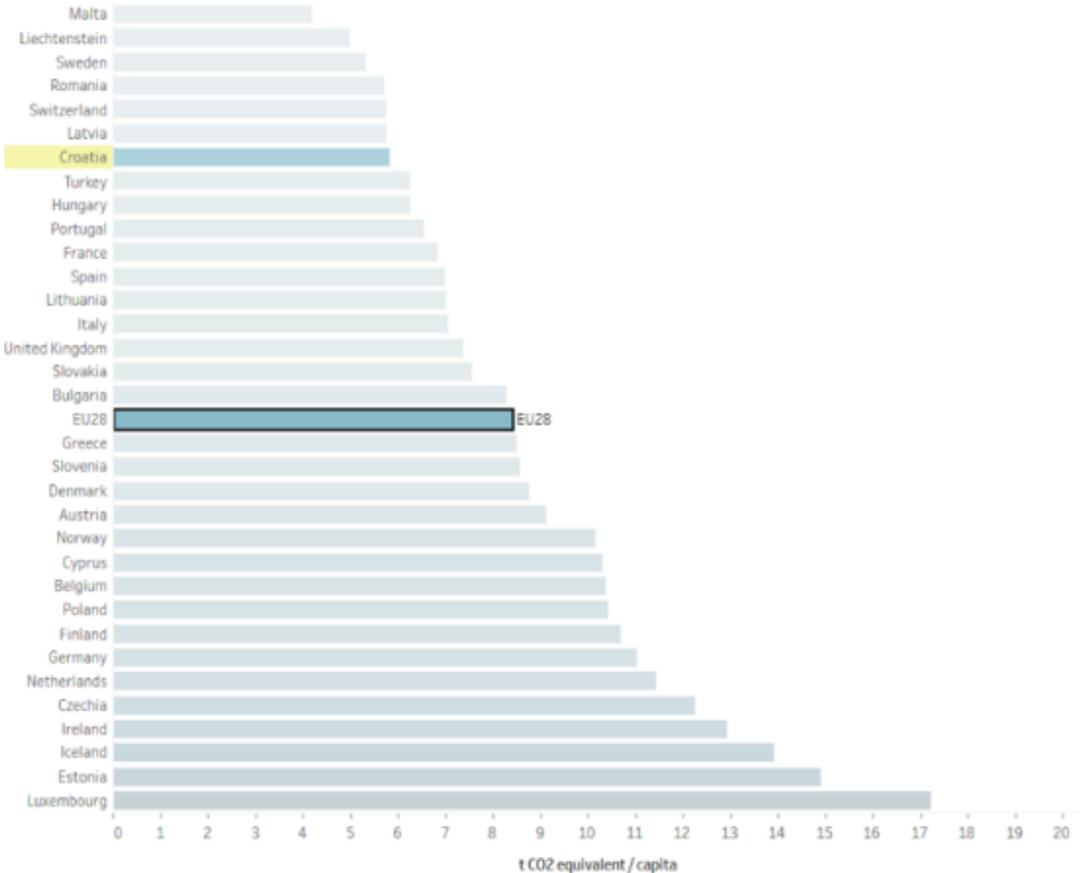


Figure 11. GHG emission per capita in 2016 (Source: EEA, 2018²⁴)



Despite these achievements, the Croatian economy remains carbon-intensive. The Croatian economy is relatively carbon intensive, with a carbon intensity that is about 20 percent higher than the EU average (Figure 12). Transport and other energy use (by households, and in commercial and institutional buildings) are the two most important sources of GHG emissions (Figure 13). In the period 1990-2016 the GHG emissions declined in all sectors except the waste and transport sectors (Figure 14), whose GHG emissions increased by 87 percent and 58 percent respectively (in the waste sector mainly as a result of the increase in waste quantity in landfills).

Figure 12. Greenhouse gas emissions intensity of the economy in 2015 (Source: EEA, 2017²³)

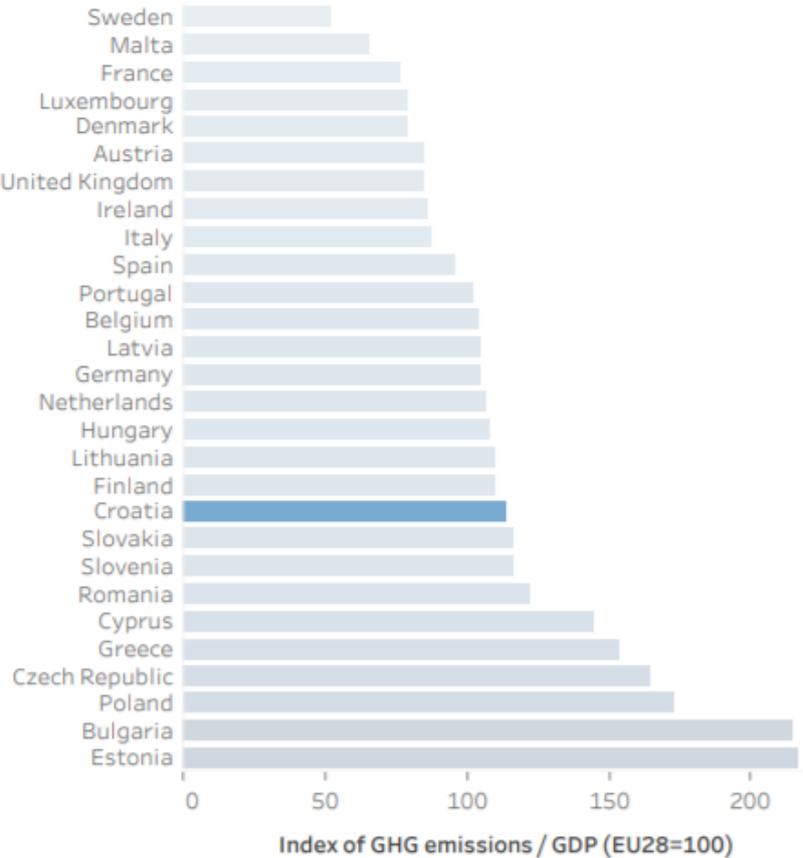


Figure 13. Sectoral GHG emissions in million tons CO₂-equivalent in 2016 (Source: EEA, 2018²⁴)

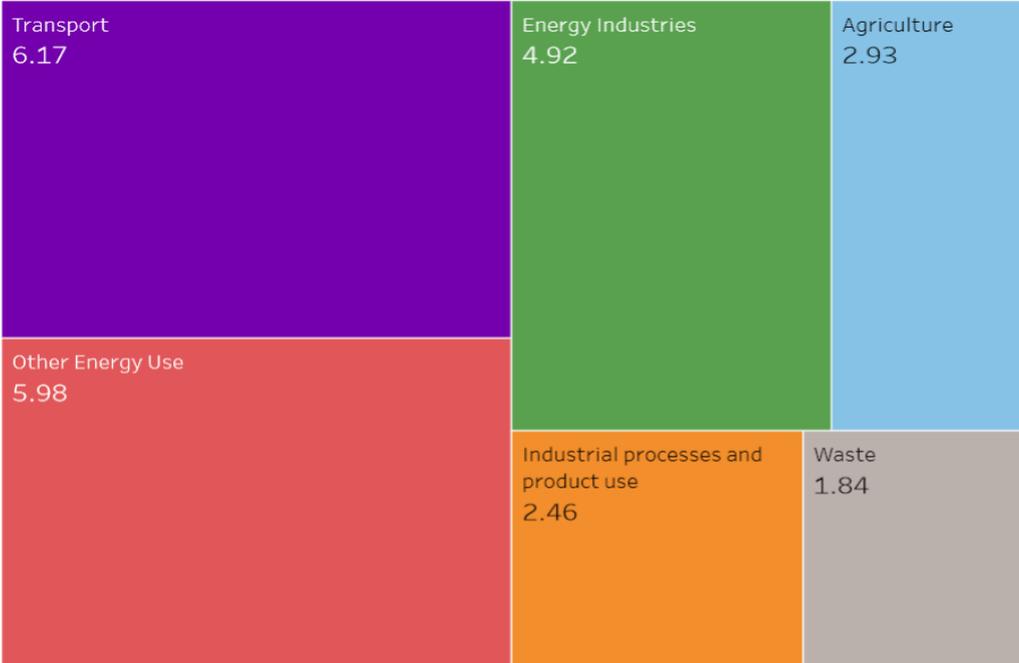
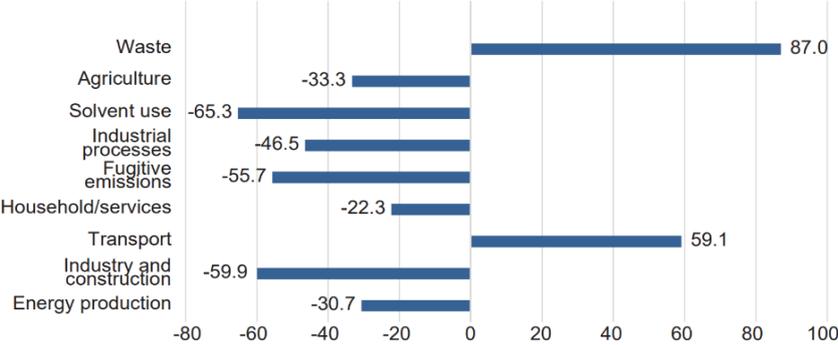


Figure 14. Share in relative change of total GHG emissions in the period 1990-2016 (after CAEN, 2018²⁵)



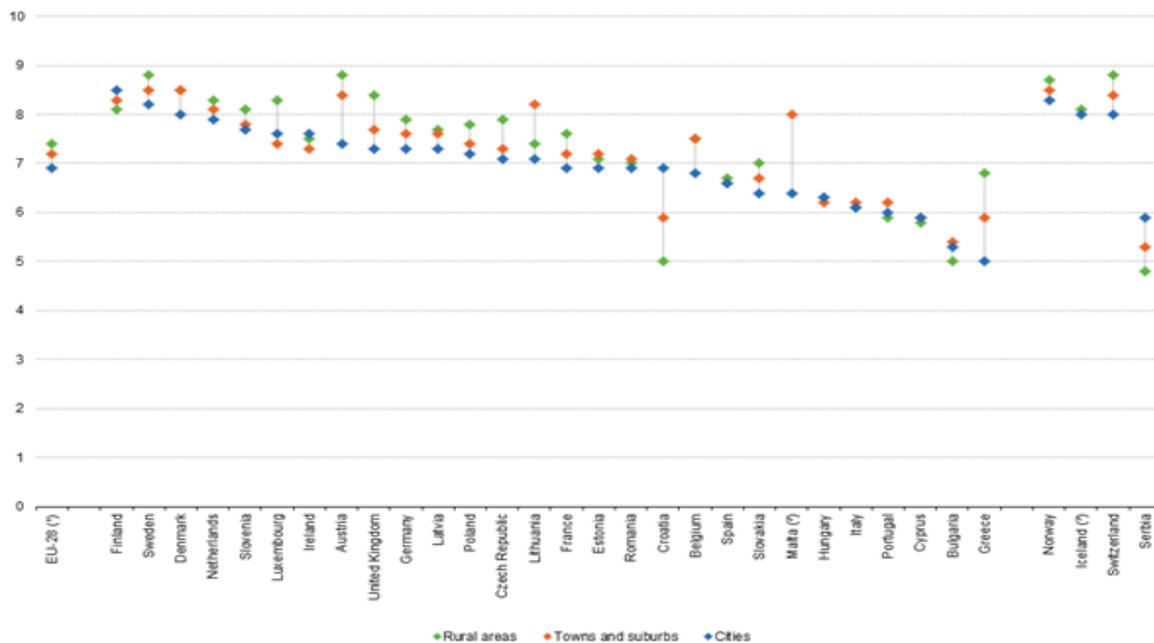
In summary, **the Croatian economy remains resource intensive**, with the scope of achieving improvements in the management of waste and water, resource efficiency, and reduction in carbon intensity.

Croatian cities are among the least green cities in Europe. The Siemens’s 2009 European Green City Index²⁶ assessing a city’s greenness on thirty environmental indicators, such as environmental governance, water consumption, waste management, and greenhouse gas emissions, ranked Zagreb 26th among thirty European cities (**Figure 15**). For one, the energy efficiency of buildings in urban areas (but elsewhere, too) is low (the building sector accounts for around 40 percent of total energy consumption in Croatia²⁷). Croatian citizens are among the least satisfied in the EU with the recreational and green areas available (**Figure 16**). Five out of seven of Croatia’s largest cities (accommodating about 30 percent of the entire Croatian population) still need to work hard to meet the EU’s standard of 26 square meters of green public area per person. With 2.7 and 3.7 inhabitants per square meter of green public area²⁸, Slavonski Brod and Zagreb perform particularly poorly.

Figure 15. Zagreb’s environmental performance is lagging well behind the average score of 30 European cities (Siemens, 2009²⁶)

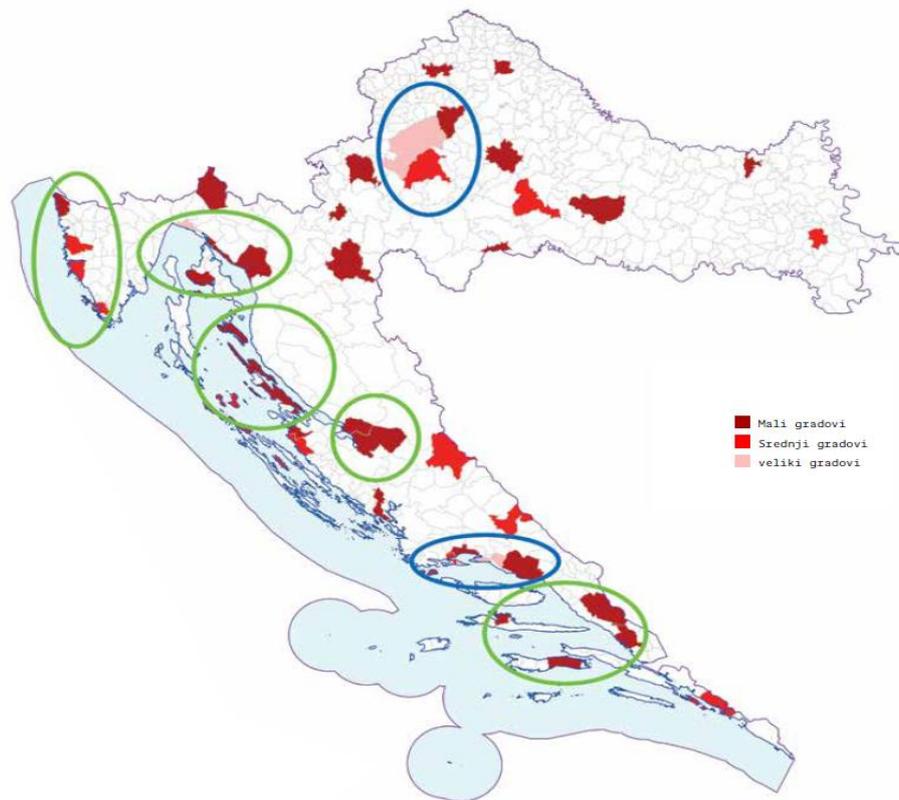


Figure 16. Proportion of people who were satisfied with recreational and green areas, by degree of urbanization in 2013 (Source: Eurostat, 2013²⁹)



Expanding grey infrastructure and illegal construction is leading to land fragmentation and landscape degradation. Rapid urban development, with the expansion of grey infrastructure for transport and new housing, is a major cause of land fragmentation in Croatia. Spatial imbalance in population density is increasing between the biggest cities (e.g. Zagreb and Split) and dynamic coastal areas on the one hand, and inland areas on the other. While the former are heavily populated and characterized by intensive levels of land use (although often lacking public facilities as well as green public areas), the latter face a decline in the number of inhabitants. Intensive and often uncontrolled construction in 1990s and early 2000s, especially in fast-growing coastal settlements, has led to landscape degradation and decreased the quality of life in urban areas. This problem is particularly pronounced in some urban areas (marked with circles in **Figure 17**). In the areas affected by illegal construction, many buildings were legalized through a legalization process whereby the Act on Proceeding with Illegally Built Buildings was implemented. In the coastal counties, more decisions on legalization were made along the coastal area than in the hinterland (e.g. Zadar), while in the counties on the mainland most decisions on legalization were recorded in cities and their immediate surroundings (City of Zagreb, Varaždin, Koprivnica, Osijek, etc.). The implementation of integrated measures on the protection and management of the marine environment and coastal zone is still lagging behind, largely due to the lack of an effective operational framework and policy instruments, as well as insufficient implementation capacities³⁰.

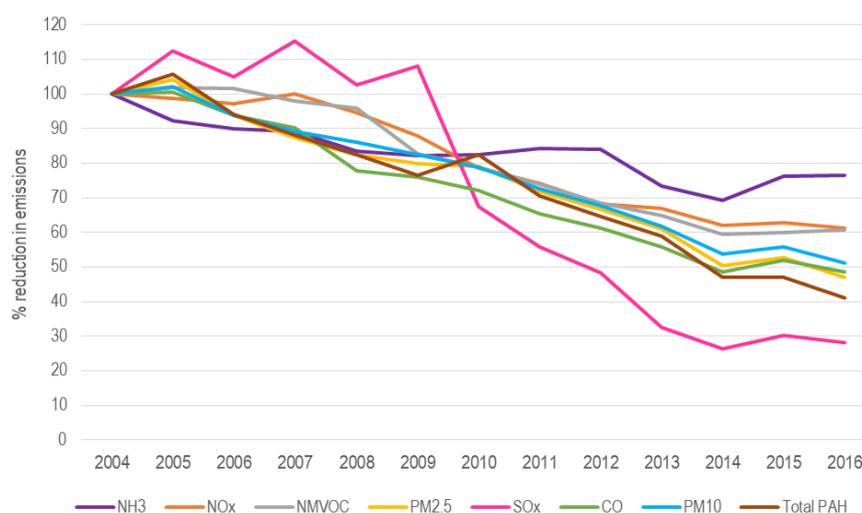
Figure 17. Cities encountering problems with illegal construction (Source: Mišetić et al., 2018³¹)



2.3 Are environmental risks well managed?

The emissions of air pollutants that contribute to poor air quality have steadily fallen in Croatia. Since the mid/late 2000s there has been a clear declining trend in emissions of all major air pollutants (Figure 18). With the exception of NH₃, levels of air pollutants have decreased by 40 percent or more since 2004. Even NH₃ emissions have declined, although not by as much. The decline in emissions is due to the enforcement of stricter environmental legislation and the implementation of voluntary air emission reduction measures, mainly in energy production (through gasification, electrification, use of renewable energy, phasing out of coal power plants), residential buildings (through improvements in energy efficiency, reduced reliance on solid fuel heating, renewal of appliances, extended district heating and gas networks), transport (renewal of vehicle fleet, use of “Sulphur-free” diesel and gasoline fuels, use of particulate matter filters in diesel vehicles, better public transport), industry (use of best available technology measures) and agriculture (reduced number of livestock and mineral fertilizer use).

Figure 18. Emission trends of major air pollutants (modified after EEA, 2019³²)



Despite these improvements, a significant fraction of Croatians in urban areas continue to be exposed to PM_{2.5} concentration levels that are higher than those considered to be safe for human health. In 2017, according to the Croatian Agency for the Environment and Nature, the Average Exposure Index (AEI) to PM_{2.5} across the country was 20.4 $\mu\text{g PM}_{2.5}/\text{m}^3$ ³³. This is substantially higher than the 16.45 $\mu\text{g PM}_{2.5}/\text{m}^3$ levels which Croatia aims to reach in 2020³³. That year the PM_{2.5} concentration threshold of 25 $\mu\text{g}/\text{m}^3$ was exceeded at two out of ten monitoring stations: in Velika Gorica (Zagreb Agglomeration) (26 $\mu\text{g}/\text{m}^3$) and Slavonski Brod (Industrial Zone) (37 $\mu\text{g}/\text{m}^3$)³³ (Figure 19), suggesting that in 2017 approximately 25% of the Croatian population might have been exposed to an elevated concentration of PM_{2.5}. The situation is likely to be even worse as, that year, PM_{2.5} concentrations were not measured in Osijek (the fourth biggest city in Croatia), which was reported to exceed the threshold for PM₁₀ concentration³³. A 2016 estimate suggests that as much as 73% of the PM_{2.5} emission were from non-industrial combustion plants (commercial, institutional and household sectors) and another 8% from transport³⁴. Moreover, PM_{2.5} emissions peak in winter months (Figure 20), suggesting that residential heating is one of the most significant sources of PM_{2.5} emissions. Croatia also likely receives air pollution from its neighboring countries.

Figure 19. Assessment of the PM_{2.5} pollution in 2017 (Source: HAOP, 2018³³)

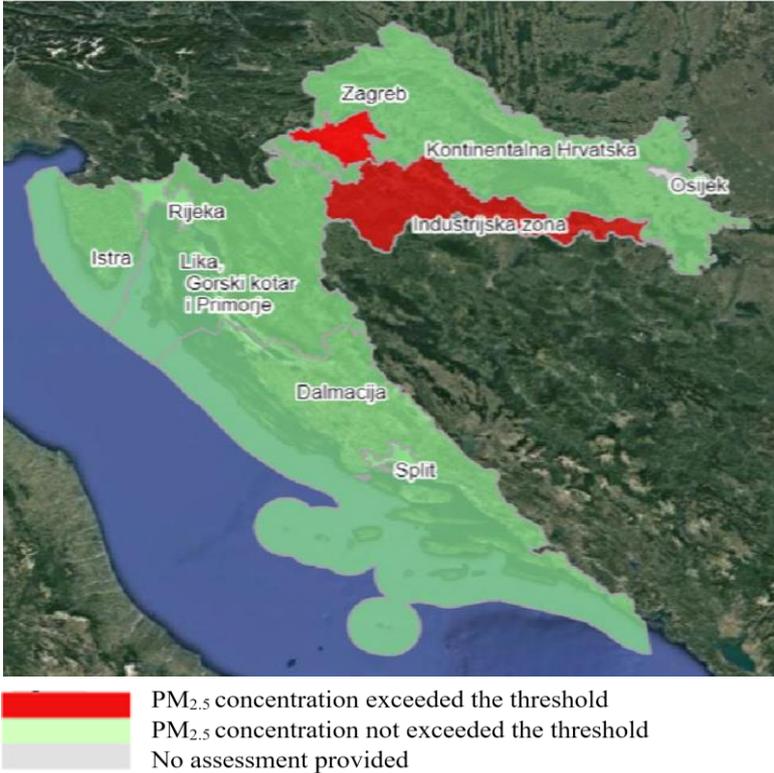
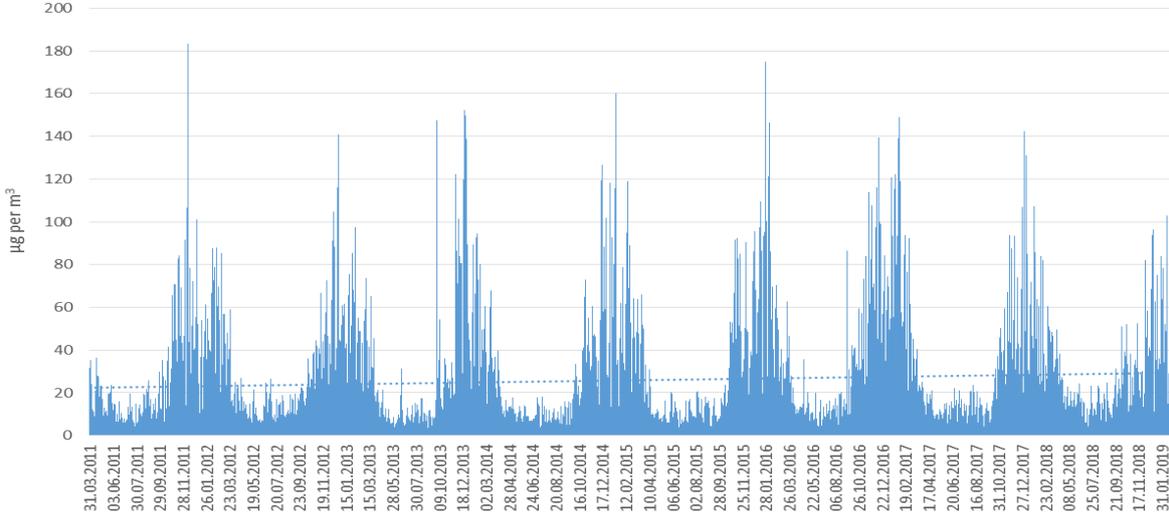


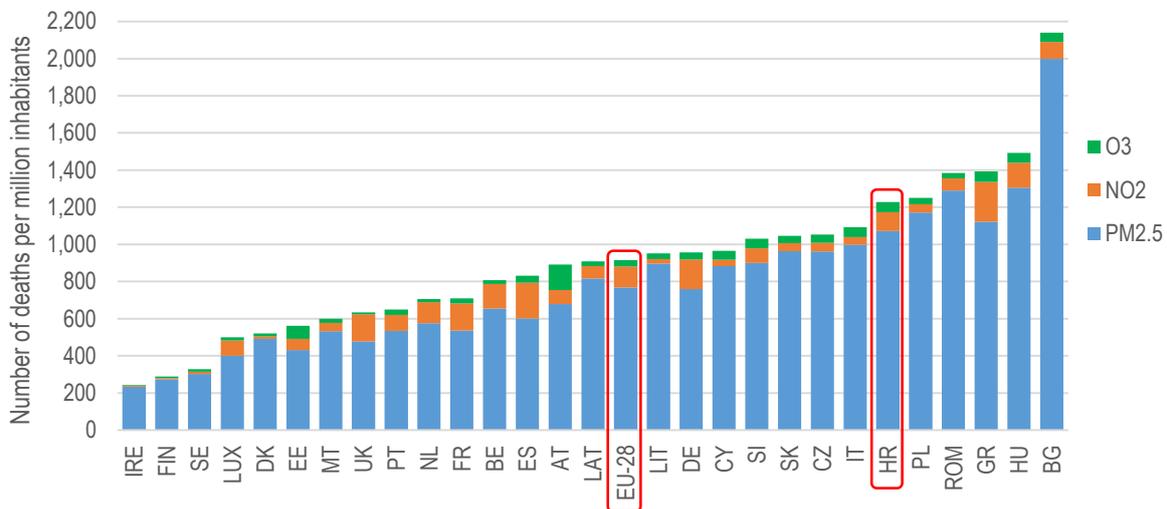
Figure 20. PM_{2.5} pollution at air quality monitoring station Slavonski Brod-1 (Source: after HAOP, 2019³⁵)



Ammonia emissions also remain high. Croatia has met the air pollutant emission ceilings that were set by the 2010 NEC Directive and the 2020/2030 reduction commitments for pollutants (other than for ammonia). In 2016 the ammonia ceiling was exceeded by 16 percent, ranking Croatia as the EU MS with the second largest exceedance level in the EU-28³². Nearly 85 percent of ammonia emission originates from agriculture³⁴.

Air pollution is a significant cause of premature deaths in Croatia. Among member states, Croatia has the sixth highest death rate attributable to air pollution (**Figure 21**). Like elsewhere in the EU, most premature deaths in Croatia are caused by exposure to high PM_{2.5} concentration.

Figure 21. Number of deaths attributable to ambient pollution by PM_{2.5}, NO₂ and O₃ in 2015 (author's own calculation after EEA, 2018⁵ and EC, 2018³⁶)



According to the WHO/OECD the economic cost of premature deaths from ambient PM_{2.5} pollution and household air pollution in Croatia in 2010 was equivalent to 10.8 percent of GDP (approximately 6 billion EUR), ranking Croatia as the EU country with the fourth largest costs attributable to air pollution³⁸. Air pollution is imposing considerable economic costs by increasing medical costs and reducing productivity by increasing the number of working days lost³⁷.

Besides being harmful to human health, air pollution also leads to environmental degradation, including the degradation of natural ecosystems. The atmospheric deposition of sulphur and nitrogen compounds (SO₂, NO_x and NH₃) cause acid rain that damages materials (stone, metal, etc.), buildings (monuments, houses, etc.), crops, forests and other ecosystems. Although reliable data on the actual (and long-term) economic damage of acid rain is limited, the impact is considered to be significant and the problem seems to have been worsening over time, most notably in the forestry sector³⁹. Acid rain is one of the causes contributing to the dieback of Silver fir (*Abies alba*), the most widely distributed and the most important commercial conifer species in Croatia⁴⁰. Besides being essential for the timber industry, Silver fir also is essential for balancing the water regime in the Danube and Adriatic River Basins as well as the water supply in most of Croatia⁴¹. Due to acid rains, forests are also damaged in Croatian national parks. In the Gorski Kotar region, at the very heart of Croatia's coniferous forests and forestry industry, as much as 75 percent of precipitation is classified as acid (pH<5.6)⁴². The problem exists also in the most famous Croatian national park – Plitvice Lakes⁴³, a UNESCO World Heritage site – potentially affecting the tourism sector by damaging the landscape.

Croatia is one of the countries that is most vulnerable to climate change within the EU. In Croatia, temperatures are already increasing, precipitation appears to be decreasing, and there appear to be more extreme weather events – especially droughts and heat waves⁴⁴. Climate models suggest if emissions continue to increase globally, the period between 2040-2070 will be, on average, between 2.6 and 2.9° warmer throughout Croatia during the summer⁴⁴. Climate change is also expected to further

decrease precipitation, impact snow cover and surface runoff, and cause more severe and more frequently occurring extreme weather events⁴⁴. The main expected impacts that can lead to high vulnerability are rise of the sea level, the warming of seas impacting marine fisheries, impacts on hydrology and water resources, and impacts on forestry (through increased incidence of forest fires, for example), agriculture (due to a change in the duration/length of the vegetative period of agricultural crops, for example), biodiversity and human health (by changes in epidemiology of chronic non-infectious diseases, for example)⁴⁴. Coastal areas will be particularly vulnerable with, for example, rises in sea levels leading to coastal erosion.

Climate change events are already leading to economic damages and these damages are only expected to grow. Already, together with the Czech Republic and Hungary, Croatia belongs to the group of EU MS with the highest share of the damage from extreme weather and climate events in relation to GDP⁴⁵, with an average annual cost of about 68 million EUR. Damages are projected to grow in the future, most notably in the agriculture, fisheries, tourism and transport sectors, with costs increasing to several hundred million EUR²¹. Croatia's infrastructure (rails, roads, gas pipelines, electricity transport, energy plants, airports, ports, etc.) is expected to be severely hit by climate change by the end of this century. The damage by climate-related hazards expressed as a share of the gross fixed capital formation (GFCF, a measure of the annual investments in fixed assets) at risk is expected to rise progressively from the present 0.21 percent to 4.54 percent by the end of this century, which is higher than in any other EU MS⁴⁶. The energy sector is similarly vulnerable. It is projected that electricity production in hydropower plants could decrease by up to 10% in all seasons except for the winter due to reduced precipitation and lowered flow rates. Additionally, the production of electric and thermal energy in thermal power plants could fall due to insufficient cooling of the plants. Climate change is also expected to negatively affect Croatia's marine resources. The temperature in the Adriatic Sea is expected to rise by 1.6-2.4°C by 2070, resulting in fish migration to the North, changes in fish species composition and the spread of more invasive marine species⁴⁷. Climate change could also negatively impact Croatia's tourism sector by altering Croatia's landscape and its attractiveness as a tourism destination, damaging coastal infrastructure (such as for water supply and drainage, hotels, etc.)⁴⁸.

Climate change is also expected to negatively impact coastal zones by reducing the availability of water, posing a challenge to the population and economy. Coastal zones suffer from a very large variation in water demand based on seasons, due to seasonality of tourism. This puts a growing pressure on the existing aging water supply infrastructure. With the looming impacts of climate change and the increase in tourism and intrusion of sea in groundwater due to rising in sea levels, more ground water is likely to become salty. The risk of inadequate water service provision and water security in the coastal zone will represent a growing issue for both the population and economy.

To sum up, **Croatia faces a number of environmental risks – with climate vulnerability being the most pressing one.** These risks are imposing a cost on Croatia's economy, and lowering the quality of life of Croatians.

3 Assessment of the main development challenges and opportunities for Croatia

3.1 Leveraging Croatia's Natural Capital for Green Growth

While natural capital is already contributing to economic growth in Croatia, the country has the opportunity to further leverage its natural wealth to grow its tourism sector and to diversify its tourism offering. In 2017 only two national parks – Plitvice Lakes and Krka – accounted for 77 percent of all tourists that visited Croatian national and nature parks, as well as 91 percent of all revenue generated by protected areas (Table 3), pointing to the unexploited potential of expanding tourism in other national parks. Moreover, the majority of Croatian nature protected areas are located in economically less-developed regions, and tourism development offers the opportunity to develop these areas⁴⁹. However, further development of tourism in nature protected areas needs to be balanced against the carrying capacity of these areas, as mass tourism can threaten their ecological value and functioning – as is starting to be the case in Plitvice Lakes and Krka National Parks.

Table 3. Estimated number of visitors and revenue of Croatian protected areas in 2017 (own calculation based on Kreitmeyer, 2018¹³, Kovačević, 2019⁵⁰, HAOP, 2018⁵¹ and MZOE/UNDP, 2017⁵²)

National and nature Parks	Visitors			Revenue	
	Visitors per km ²	Total number	%	Estimated revenue (EUR)	%
National Park Plitvice Lakes	5,806	1,724,382	44	51,731,460	70
National Park Krka	11,613	1,265,817	33	15,189,804	21
National Park Brijuni	4,997	169,398	4	2,032,780	3
National Park Mljet	2,654	142,520	4	1,710,238	2
National Park Paklenica	1,478	140,410	4	982,870	1
National Park Kornati	1,062	34,515	1	345,150	0
National Park Risnjak	261	16,574	0	165,735	0
National Park Northern Velebit	205	22,345	1	156,415	0
Nature Parks	-	365,159	9	1,460,636	2
Total	-	3,881,120	100	73,775,087	100

To leverage its natural wealth and to reap these economic benefits, however, Croatia needs to further strengthen the management of its protected areas⁵. Once an SCI is designated, the Habitat's directive allows for a 6-year period before its designation as a Special Areas of Conservation (SACs). For Croatia this timeframe will expire at the beginning of 2021. The management of Natura 2000 network requires substantial financial means and these are currently only partly available. In addition, a lot of time and energy is spent on the complex and administratively demanding task of issuing licenses for undertaking alterations in Natura 2000 sites. People working in the nature protection sector currently do not have sufficient capacity to adequately manage these areas and to educate visitors about these natural

⁵ The nature protected areas in text that follows refers to both, protected areas under the Nature Protection Act and Natura 2000 areas.

assets. Though most protected areas have management plans, these management plans need to be revised and improved in order to adequately address the conservation of Natura 2000 species/habitat types. The synergy with and utilization of tourism-related services offered by the local population in the areas surrounding nature protected areas is also insufficient.

At the same time, the impacts of tourism need to be managed so that tourism does not degrade the natural environment. The European Environment Agency has warned that, especially in the Mediterranean, the density of tourism and related infrastructure and activities may have irreversible consequences for biodiversity and could lead to habitat deterioration⁵³. Increases in the number of tourists also have an impact on waste generation and energy consumption and, on average, a tourist consumes 3-4 times more water per day than a permanent resident⁵³. The Plitvice Lakes National Park, for example, is crowded with tourists in the summer months, which in turn has led to the rapid expansion of tourism facilities that are causing water pollution due to their excessive water usage and inadequate sewage systems. Landscape diversity is particularly threatened along the Adriatic coast due to accelerated urbanization, in part as a result of tourism.

Apart from tourism, other benefits from ecosystem services derived from the Natura 2000 network can be triggered through the use of economic instruments. A range of benefits can be triggered by ensuring the effective protection and restoration of Croatia's natural capital, especially under the Natura 2000 network. Measures for boosting ecosystem services can be powerful economic drivers in several economic sectors such as agriculture, forestry and fisheries⁵⁴. All these sectors rely on natural capital and benefit from ecosystem services but are not proactively involved in nature protection. Nature protection, notably the management and financing of Natura 2000 network, is often perceived as solely a nature protection sector's task, rather than a task which must be shared among all sectors. Croatia has not created markets for ecosystem services through economic instruments such as payments for ecosystem services to trigger such financing. Moreover, nature protection actions are not properly embedded into sectoral policies. Although the Nature Protection Strategy and Action Plan⁵⁵ requires the integration of nature protected-related objectives and activities into all sectors whose activities depend on or may have (positive or negative) impacts on biodiversity, the level of this integration is still not sufficient, including within key sectors such as agriculture, fisheries, forestry, hunting and water management.

Though Croatia is water abundant, irrigation at present is insufficient and can be enhanced to promote economic growth in agriculture. An important constraint to potential increases in the performance of the agricultural sector is the lack of adequate irrigation systems. This considerably limits the country's agricultural potential, as analysis shows that it is not feasible to increase the production of high-value crops without supplemental irrigation. However, the main obstacle to develop irrigation is not the lack of money, available water or support for infrastructure development (e.g. construction of main irrigation channels). The main obstacle is the fragmentation of agricultural plots and the lack of willingness among farmers to invest in on-field irrigation systems (e.g. pipes) and connect them to the main irrigation channels built by authorities.

3.2 Striving to make growth resource-efficient, low-carbon and green

Waste management is constrained by number of factors, many of which were identified in 2005 through the National Waste Management Strategy (NWMS). Sectoral challenges identified in 2005 through the NWMS still remain, and include: inconsistent implementation of existing regulation; insufficient awareness among local stakeholders about their waste management responsibilities; inadequate

data systems for waste system requirements; ineffective decision making on siting and technology, particularly for the development of the regional WMCs; and lack of cooperation between LGUs to establish the infrastructure and public services necessary for an efficient, modern waste management system.

The sector has been suffering from uncertainty in the regulatory framework. The finalization of the National Waste Management Plan (NWMP) was delayed by three-years, reducing Croatia's ability to secure EU funds for key waste management investments and support Local Government Units (LGU)s in planning for separate collection systems. The NWMP and the Implementation Decision on NWMP lack consistency in several areas, such as the timeline of implementation, as well as the number of WMC to be built⁶. Moreover, deadlines for the implementation of new regulations are often not realistic (e.g. the decision on the sequencing of landfills' closure entered into force only a few days before the deadline). The frequent changes in the regulatory framework, in turn, hinder the private sector's participation and make legislation more difficult to enforce.

Local Government Units, which are mainly responsible for waste management, do not have financial or regulatory incentive to move the agenda forward. Implementation of waste management is decentralized in Croatia, with the main responsibility being placed onto local government units (LGUs). LGUs currently deposit unsorted mixed municipal waste on non-compliant landfills, and pay solely for landfill operational costs, which range from 10 – 20 EUR/t. With the planned WMCs, the cost of landfilling is estimated to be around 100 EUR/t. Consequently, in the current system, the LGUs have no incentive to speed up the agenda, to introduce separate collection systems and to establish WMCs as these would lead to increases in operational costs. The right financial incentives to encourage the reform of the sector and meet EU targets are not in place. The introduction of a landfill tax would help divert waste from landfills and encouraging recycling. However, the landfill tax is yet to be implemented. The economic incentives have proven effective to move the waste agenda forward across Europe. For example, twenty-four out of the twenty-eight EU member states have a landfill tax, which acts as an incentive to divert waste from landfills and channel it towards treatment and recycling. Tax rates vary from 3€/t (LT) to more than 100€/t (BE). The revenues are often used to finance additional investments in the sector. Furthermore, eighteen EU member countries have introduced a landfill ban on sending recyclable waste, such as paper and plastic, to landfill.

The lack of coordination between different level of governments and lack of capacity are challenges that contribute to increasing costs. The majority of measures, such as separate collection and organization of recycling, fall under LGUs, while planning of the WMC falls under the Regional Government Units (RGU). This separation of functions in turn requires coordination between the local and regional government units that is often missing. Planning for WMC, for example, requires an understanding of how much waste will be generated at the LGUs and LGU plans for separate collection of waste. Lack of coordination on these aspects contributes to over or under capacity at the WMCs leading to increased cost of service, as is currently the case at two constructed WMCs – at Kaštijun and Marišćina. Most of the 556 LGUs, with the average LGU size of 6,000 inhabitants (without City of Zagreb), have limited technical, organizational and financial capacity to implement the NWMP. Planning thus far has usually involved a focus on capital investment costs and adsorption of EU funds, leading to underestimations of operational costs.

⁶ Other examples of contradiction include: a) differences in number of planned WMCs with one planning for 11 WMCs while the other for 13); b) differences in scope and content; and c) differences in guidelines for budgetary investments. Moreover, both documents provide unreliable cost estimates and lack a strategic focus to ensure that the measures that have been prioritized will in fact help achieve the EU waste objectives. Lastly, the national WMP has been significantly underestimated (e.g., for the closure of unsanitary landfills and construction of new WMCs, a gap of HRK 1 billion has been identified).

Inadequate infrastructure for waste management hinders the adoption of better waste management practices. With more than 100 non-compliant landfills in operation, Croatia is facing infringement penalties. There are however no options for closing such sites as WMC are yet to be constructed. In 2005, the NWMS and following NWMP planned for 20 waste management centers. The numbers of planned centers have since been reduced due to the improvements made in separate collection. Nonetheless, by early 2019, only two centers – Marišćina and Kaštijun had been constructed. Even these are yet to be fully operational, as the supporting infrastructure, such as transfer stations, has not been developed.

Compliance with EU water directives is facing significant operational and financial challenges. The progress of harmonization with EU water directives remains slow and is seriously behind schedule. This is largely due to the inefficiency of public water and sanitation service providers. This has the effect of raising water prices and has the potential to create an issue of affordability for the poorer segment of the population. The provision of water and sanitation services in Croatia is highly fragmented, with more than 150 local or regional public water utility companies. Croatia's need to align its water sector with the EU water *acquis* creates a new financial and organizational challenge for the sector. The objectives of the EU Water Framework Directive (WFD) rely heavily on the successful implementation and achievement of the requirements of other key EU Water Directives, such as the: Urban Wastewater Treatment Directive (UWWTD), Drinking Water Directive (DWD) and Nitrates Directive (ND). The implementation progress of projects/actions necessary to fulfil the requirements of these Directives in Croatia is insufficient. Significant losses in the public water supply system (approximately 44 percent) point to investment and maintenance backlogs.

One of the main bottlenecks for UWWTD implementation has been the lack of institutional capacity of the implementing utilities, given the size and complexity of investment projects. The water supply and sanitation sector in Croatia has never had to implement a national investment program of such magnitude before. While utilities often create special project implementation units (PIUs) to implement investments, these new units have to be trained and nurtured, and have faced multiple practical challenges during the projects' preparation and implementation processes. In addition, the pressure of investments to abide by compliance deadlines has not always allowed designers and local communities to look for the best technical and financial solutions.

The water service provision sector's organization is inefficient, and reform is long overdue. The sector is over fragmented with a few larger, sustainable water utilities, but with a large number of small water utilities that have no capacity or resources to develop and sustainably operate new facilities required for alignment with EU directives. This requires reforming the sector's organization, to improve longer term sustainability and operational efficiency. The main drivers of this effort are the fulfilment of EU water directive requirements. The key element of the water sector reform is implementation of water utility regionalization process, which should strengthen capacity of water utility for preparation, implementation and operation of EU funded investments required for EU directive fulfilment. The process is a unique opportunity for the sector to develop modern, efficient service providers.

The urgency to tackle waste can provide an opportunity to turn waste into a resource and create a circular economy. Croatia has only recently started the transition from a linear to circular economy, and there is, as of right now, no long-term push in terms of policymaking, incentives and other tools to bring about systematic changes in business and market models, public awareness campaigns, etc. As noted, Croatia is lagging behind current EU waste management standards and good practices. As there is a pressure and urgency to modernize the waste sector, Croatia can benefit from lessons learnt in the EU, jump to the next stage development and instead of going the "old route", immediately start planning and implementing more advanced policies to promote a circular economy. Having a dedicated

department or focal point responsible primarily for handling the circular economy would help the process.

The lack of R&D, eco-design, and eco-innovation has hindered the development of the circular economy in Croatia. Eco-innovation is an important vehicle contributing to environmental protection and sustainable development in general. But eco-innovation can also create new jobs. The turnover of the EU eco-innovation sector equals to 2.2% of the EU’s GDP – outperforming the European aerospace or pharmaceutical industries. A very low share of public investments are currently allocated to research and development in the field of energy and environment (**Figure 22**), resulting in too few low-carbon technologies patents (**Figure 23**) and eco-innovations that could, in turn, be important vehicles for boosting the circular economy. Nonetheless, Croatia has made some progress: in 2013 Croatia ranked fifth from the bottom in a ranking of EU countries on an eco-innovation label; in 2017 it had moved up four places (**Figure 24**), and it needs to continue rising up.

Figure 22. Share of public energy and environmental R&D expenditure in total public civil R&D in 2013 (Source: EC, 2017⁵⁶)

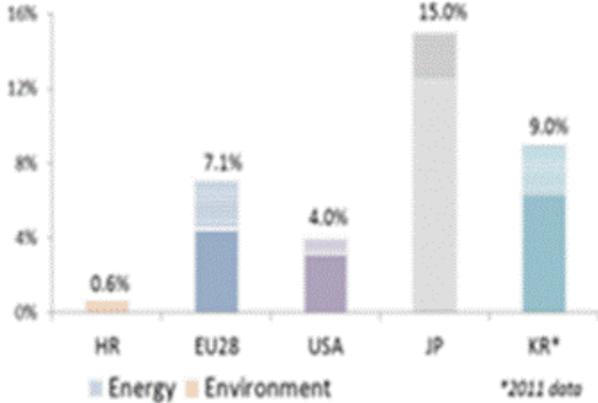


Figure 23. Low-carbon technologies patents applications (patents/mln. inhabitants in 2011) (Source: EC, 2017⁵⁶)

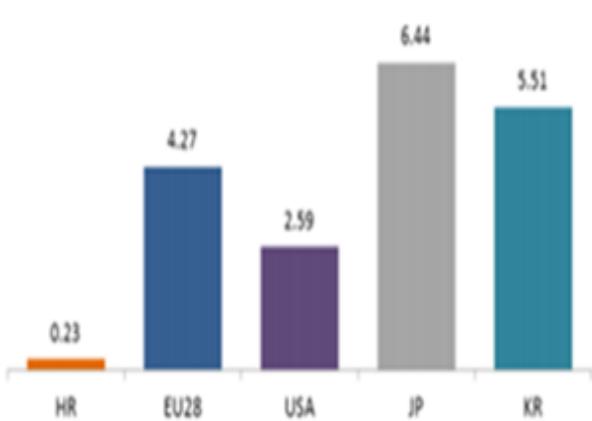
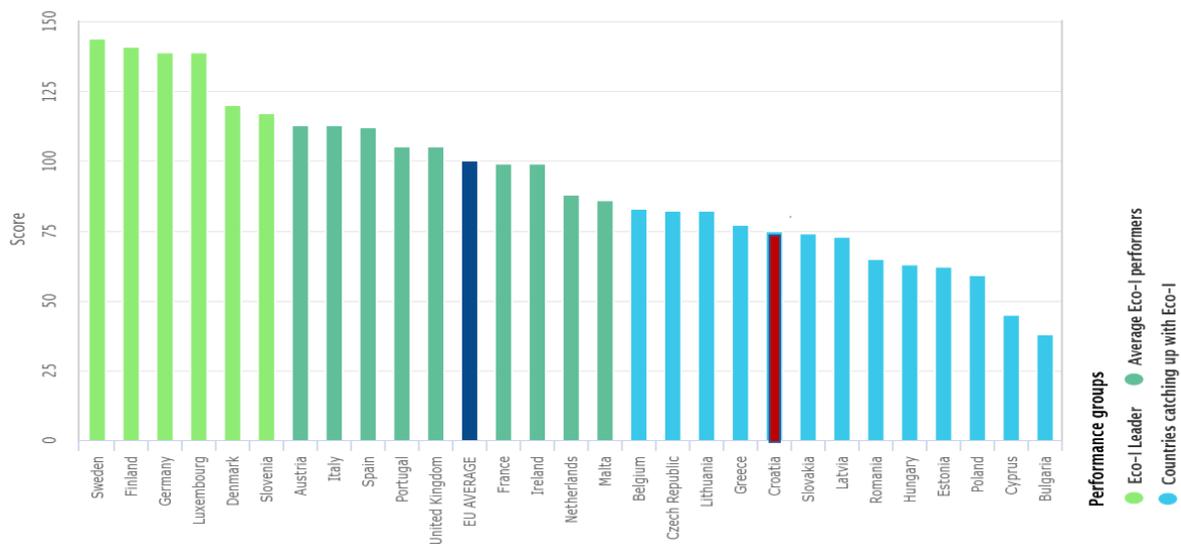


Figure 24. Eco-Innovation Index in 2017 (EU=100) (Source: EC, 2018⁵⁷)



Croatia has an opportunity to benefit from its low-carbon growth through the emissions trading scheme. While GHG emissions have been steadily falling and Croatia will meet the EU’s 2020 reduction targets, Croatia can further reduce emissions as co-benefits from other sectoral interventions. For example, addressing air pollution will also help reduce emissions from one of the main sectors – households and commercial and institutional buildings. Similarly, the largest increase in greenhouse gas emissions was recorded in the waste sector (87%), which is mainly due to the increase of waste in landfills. As waste management improves, this source of emissions will also subside. Croatia has been allocated a quota of 18,286,692 emission units in the period 2017-2020. The expected revenue from the sale is about 120 million EUR., which will be paid into the Environmental Protection and Energy Efficiency Fund⁵⁸. Further reductions in emissions can increase the revenue from sales of emission units.

A comprehensive policy on green cities needs to be developed. Hardly any city has a comprehensive, operational policy on how to implement the green cities concept in practice and monitor its environmental performance. Spatial designs in urban areas do not sufficiently integrate green elements and do not follow new environmental trends, such as the implementation of low-energy intensive/passive buildings, prevention/reduction of urban heat islands, increase of green public areas, urban biodiversity improvement, etc. At present there are no specific national or EU funding mechanisms earmarked for the implementation of green city projects, which the administration working in this field considers to be one of the main bottlenecks for launching the green city ideas off the ground.

Limited use of spatial planning is preventing the implementation of green city concepts. Croatia has a comprehensive regulation on spatial planning and a well-elaborated Spatial Development Strategy. However, spatial planning is not always prioritized. Furthermore, spatial planning is not sufficiently integrated in sectoral policies and decisions that affect the environment. Consequently, rapid and sometimes uncontrolled construction, especially in fast-growing coastal settlements, leads to landscape degradation and is threatening the health of natural ecosystems. Such unplanned construction has resulted in settlements where basic services are not being provided (e.g. public drinking water supply and sewage, kindergartens, separate waste collection, etc.) and in which it is very challenging to implement green city concepts.

3.3 Managing Environmental and Climate Change Risks to Growth and Quality of Life

Air pollution management legislation in Croatia is adequate and has supported the implementation of a range of measures aiming to reduce pollution. Air pollution legislation and targets in Croatia are aligned with and follow the EU Framework of the "Clean Air for Europe" (CAFE) Programme. The air quality monitoring network is adequate, with air quality being monitored in settlements and cities where the more significant pollution occurs. Emission reduction measures have been implemented to tackle industrial pollution, as well as emissions from transport and residential buildings. Cities that are in non-compliance have prepared the air quality monitoring plans and started implementing reduction measures (Zagreb, Rijeka, Osijek, Sisak, Slavonski Brod, Kutina, Velika Gorica and Bakar). However, in many rural and suburban areas, open burning of municipal waste and/or agricultural waste, although banned, is still being practiced.

The next set of measures to reduce PM_{2.5} emissions will need to focus on emissions from non-industrial combustion plants and transboundary pollution. Although, and as noted before, Croatia significantly cut air pollutant emissions in the last decade, in the period 2014-2016 there have been no significant cuts in air pollutant emissions (Figure 18). This suggests that the current emission measures might not have the potential to reduce air pollutant emissions much further than they already have. Moreover, with 73 percent of PM_{2.5} emissions coming from non-industrial combustion plants³⁴, the focus of pollution management programs will have to be on this pollution source. Improving the combustion of fuels used in these operations by providing improved biomass stoves (e.g. using pellets) and/or replacing solid fuels (wood and coal) with more environmentally friendly or cleaner fuels (such as gas) will be required in order to reduce emissions. Modern clean burning stoves, designed to meet the new Ecodesign requirements, which will come into force on January 2020 for biomass boilers, and on January 2022 for domestic biomass appliances (for stoves, fireplaces and range cookers) will reduce particulate emissions by 80-84% compared to an old stove⁵⁹. Tackling biomass burning requires changes in heating appliances in a large share of households and buildings; and often in low-income households. These changes usually take a long time and require support – i.e. subsidies to help with the replacement cost. Measures to reduce emissions from the transport sector, another important source of deteriorating air quality in cities, should include the promotion of non-motorized transport (bike lanes, car-free areas and low-emissions zones, etc.) and fleet renewal. At the same time, the problem of transboundary air pollution will need to be placed higher up on the political agenda.

Additionally, farmers will need incentives to reduce ammonia emissions. The current Rural Development Programme which provides numerous grants for different rural development measures, (including some benefiting the environment) does not however have any measures targeting ammonia emissions. Without these incentives, livestock are not fed enzymes and supplements that would reduce ammonia emission, slurry is not injected in the soil but spread on it and urea fertilisers are not incorporated in the soil shortly after application, all leading to high emissions. Ammonia emissions from agriculture can be reduced by implementing demonstration projects and by providing incentives for the implementation of abatement measures.

In the medium term, additional measures to strengthen LGU's capacity and strengthening information sources will also be needed in order to address pollution. In Croatia, LGUs are responsible for the implementation of air emission measures. Many of these are small and have limited capacities to cope with this task. They need to be strengthened through a capacity building and technical assistance programme that will enable them to prepare (or improve the existing) plans for air pollution reduction and define and implement adequate air emission reduction measures. In addition, a comprehensive inventory of the damage caused by acid rains and transboundary air pollution, including an

assessment of the monetized damage, would be needed to cast more light on the source and the magnitude of the problem as well as to identify possible solutions.

Continued use of biomass, though in improved stoves and boilers, provides an opportunity to support green jobs, especially in the forest sector. The country's biomass use is high, it is relatively cheap and locally available. 85% of the forest is State-owned and well managed (all under the FSC certificate), with no illegal trade. Private forests also have to prepare management plans and harvesting is controlled. The sector, however, will benefit from reform and greater competition to realize its potential for job creation.

Croatia is expected to adopt the National Strategy and Action Plan for Adaptation to Climate Change in 2019. Some institutional mechanisms to implement adaptation measures have been established. The draft National Adaptation Strategy (NAS) covering the period until 2040 and the draft National Action Plan (NAP) were developed in November 2017. These are expected to come into effect in 2019. The next step would be to develop adaptation strategies at the subnational level. At the moment, a coastal adaptation strategy has only been developed for Šibenik-Knin County. Several adaptation projects have been carried out at the local and regional level, in particular in the area of data gathering and awareness-raising of local and regional stakeholders on adaptation. An inter-governmental organization to coordinate policies and measures for climate change adaptation (and mitigation) has been established – the Coordination Commission for Policy and Measures for Climate Change Mitigation and Adaptation (CCCCMA). This Commission is chaired by the Minister of Environment and is comprised of a Coordination Group (mainly deputy ministers from a wide range of sectoral ministries) and two technical groups (on climate adaptation and low carbon development), involving public institution, academia, business and NGO experts.

Climate adaptation actions are yet to be adequately embedded in sectoral strategies. The national legal framework requires that adaptation measures are implemented in the following vulnerable sectors: water resources, agriculture, land and marine biodiversity and ecosystems, coastal management, tourism and public health⁶⁰. However, except for some actions that are included in the energy and water sectors, climate adaptation actions have not been integrated with sectoral strategies and action plans. Climate impacts on the water regime were considered qualitatively during the preparation of the 2016-2021 River Basin Management Plan (RBMP). The Flood Risk Management Plan (FRMP) for the 2016-2021 planning period (part of the RBMP) includes measures for climate adaptation. Similarly, legislation on Environmental Impact Assessment (EIA) obligates all developers to assess climate change impacts and the vulnerability of each project, and the national Strategic Environmental Assessment (SEA) regulation requires them to consider aspects related to climate adaptation. However, some of these assessments do not provide a very comprehensive analysis, suggesting that further improvements on this practice are needed.

Croatia needs to improve river basin-based cross-border cooperation and develop additional (notably nature-based) flood protection infrastructure, in response to the increased frequency and intensity of extreme weather events resulting from climate change. Current flood protection protective measures rely on flood storage in lowland areas, with embankments and 'room for the river' providing protection in the Danube basin. The southern part of the Sava river basin has been most affected recently, particularly during the 2014 floods. Floods endanger over 15% of the country's inland territory and pose significant costs to the Croatian economy. In the May 2014 floods, an estimated 38,000 people were affected, 15,000 were evacuated and the economic burden was high (costs were estimated to be EUR 300 million)⁶¹. Floods do not respect national boundaries and are often experienced by many countries sharing a river basin. This means that integrated flood risk management must be transboundary, through measures including joint monitoring, forecasting and early warning, and through coordinated risk assessments and responses.

Droughts too pose a challenge to Croatia's economy and environment. In dry years, annual runoff is less than one quarter of the average year flow. The situation is more severe in the Adriatic basin. In 2015 for example, significant parts of the Danube River Basin were affected by droughts which negatively impacted different water-dependent economic sectors, vegetation and the aquatic environment. The agriculture sector was by far the most affected sector in Croatia, but other impacts were also felt on navigation, water supply and ecology (biodiversity)⁶².

There is scope to mainstream adaptation to climate change in insurance or alternative policy instruments to provide incentives for investments in risk prevention. Such a measure is planned in the frame of the draft NAS, but not for the first five-year implementation period.

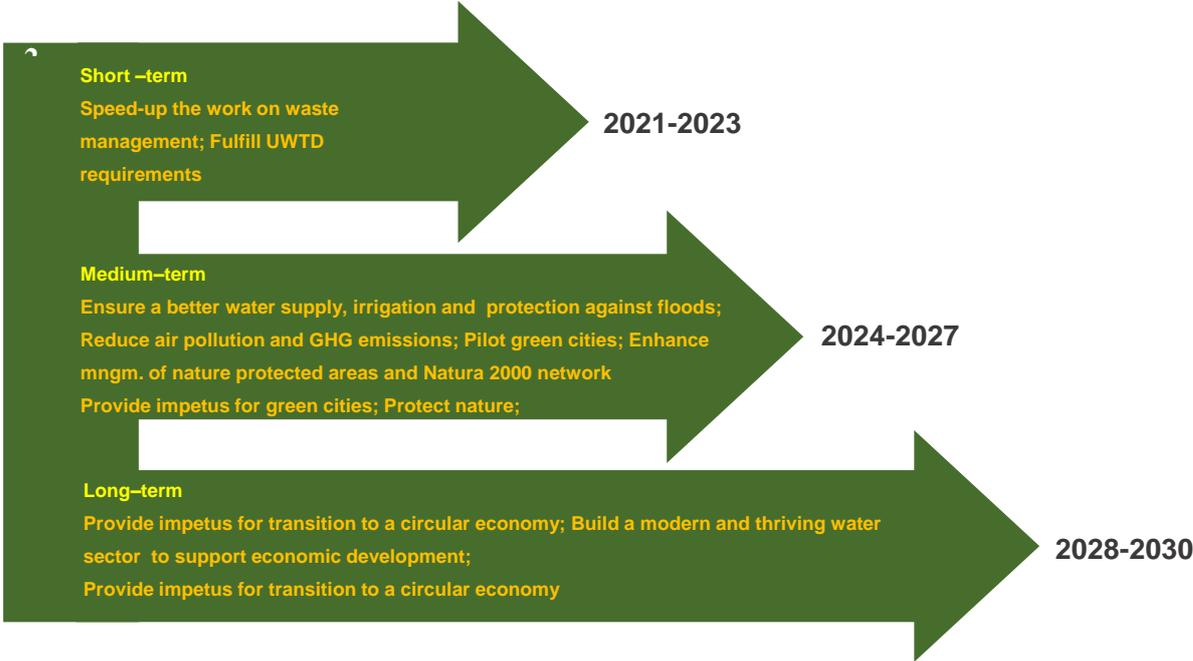
4 Prioritized policy recommendations

4.1 Overall considerations

As discussed in the previous sections, several challenges, as well as unexploited opportunities, hinder Croatia's progress towards fully realizing its "green potential" and the vision of a "Green Croatia". A range of measures – policy, institutional, and investments – are needed to allow Croatia better leveraging its natural capital for green growth, driving growth to be resource-efficient and low carbon, and reducing environmental risks that impose a cost of the economy and reduce the quality of life.

To increase the impact of sector specific interventions, the cross-cutting issue of environmental governance also needs to be addressed. Environmental governance affects a range of environmental outcomes – air pollution management, waste management, adaptation to climate change, among others. Environmental policy in Croatia is mainly based on following EU initiatives and transposing the EU's environmental regulations and requirements. Societal debates on a vision of future development based on green concepts, involving a range of stakeholders, hardly exist. Shared values (vision, mission, principles) upon which environmental policy (strategy, objectives and targets) should be formulated are very rarely discussed. There is also a need to strengthen monitoring mechanisms and evaluations of the degree to which environmental goals and targets were achieved. Except for obligatory administrative monitoring and evaluations, performance of past or current environmental policies is rarely analyzed in a systematic way through performance indicators, benchmarking, distance from reaching targets, reputation, compliance, liabilities, etc. This limits the application of lessons learnt in formulating new policies. Additionally, multi-level interaction and co-operation between a range of actors (policy makers, business, research, consumers, NGOs, etc.) is often established at the institutional level but limited in implementation. Increasing public engagement in formulating and implementing environmental policies would lead to better and more sustainable outcomes across the proposed measures. Figure 25 provides an overview and duration of the key policy actions proposed.

Figure 25. Prioritized policy recommendations and their timeframe



4.2 Short-term policy recommendations (1-3 years)

4.2.1 Speed-up progress on improving waste management

Problem: Suboptimal waste management practices pose risks to public health, increasing (high-end) tourism, and of EC infringement. For example, currently there are two areas of non-compliances with the EU Landfill directive – one related to bringing landfills in compliance by end of 2018 and the other one related to the quantity of biodegradable waste that is put into landfills. The key obstacles to moving forward include the lack the uncertain implementation environment, lack of incentives for LGU to modernize waste management, insufficient coordination between LGUs and RGUs, and inadequate infrastructure.

Approach: Strengthen incentives for LGUs to move forward with the waste agenda, accelerate investments to establish WMCs informed by regional management plans, and build the capacity of RGUs and LGUs to implement NWMP. Significant improvements in reaching the EU targets are possible (compared to the business-as-usual scenario) however, not without (i) strengthening the legislation to provide economic incentives to LGUs, and reduce uncertainty around implementation arrangements; (ii) strengthening the planning, coordination and organizational capacity at the RGU and LGU levels; and (iii) accelerating investments in WMCs, taking economies of scale and long-term sustainability into account.

Economic instruments are being widely used in EU to incentivize separate waste collection and recycling, influence behavior to minimize waste, and move away from landfilling. The introduction of a landfill tax is a first step that Croatia could take, with the primary aim of increasing the financial attractiveness of alternatives to landfilling (in this case, recycling). Collected landfill taxes could be rolled over back to the LGU through co-financing from EU funds. Other positive (e.g. rewards) and

negative (e.g. fines) incentives should be considered and/or strengthened moving forward. For example, the current EPR system run by EPEEF is predominately focused on one segment of the packaging waste (beverage packaging); this system could be extended to all packaging waste. Various fees defined by legislation are not well enforced. Incentives could also be introduced to stimulate the cooperation of LGUs in waste management to reap economies of scale.

The regional waste management systems, built around regional waste management centers (WMCs), could play an important role in the implementation of Croatia's sector policies, meeting EU requirements and ensuring the sustainability of investments. Only with the regional centers in place can local non-compliant landfills be closed and regional systems developed that will support the LGUs in segregated waste collection and management of recyclables. Investments should be informed by regional masterplans. In parallel to the regional plan, strong educational and communication campaigns should be implemented to strengthen the capacities of LGUs.

Regional masterplans would include a business plan for marketing recyclables and sustainably financing local and WMC operations, as well as private sectors initiatives that are envisaged in the operations of the WMCs or the collection and processing of recyclables at the regional level. The business plan will inform regions on the technology choices that ought to be made, particularly regarding the segregated collection of recyclables including bio-waste (composting), the sorting of recyclables and the processing of mixed waste for energy recovery purposes (RDF production or waste-to-energy solutions). Given the energy recovery needs in the waste sector, an energy recovery analysis should be conducted. While assessing energy recovery needs (current and prospective), the analysis should also consider solutions for the treatment of sludge from waste water management systems. The business plan will help define prioritized policy actions and establish sub targets at the regional level to enable monitoring.

While developing regional plans, special attention should be given to waste management on islands. With regard to waste management infrastructure on the islands, there are unique problems due to a) legal restraints which forbid landfilling; b) space limitations for constructing waste infrastructure because of the preservation of nature and orientation toward tourism, and thus, construction is discouraged; and c) the financial and organizational complexity of waste transport from the island to the mainland (especially during the tourist season).

The target: to be in full compliance with legislation on waste management, to move toward sustainable waste management systems, to create foundations for the transition to a circular economy.

Resources needed: Approximately 340 million EUR is required to build the WMCs (Zagreb WMC excluded), implying that around 13.5 million (3-5%) is needed for design work and supporting the works tendering process. Around 13.5 million EUR including all the transaction advisory services to support the preparation activities, including master-planning and all contractual arrangements to build the full regional systems would be needed to establish regional schemes (1.5-2% of total system investments estimated at 692 million EUR, including LGU level investments). On average 70% of funds could come from EU funds. In addition, if landfill tax would be introduced in late 2019 or early 2020, around 27 mil EUR could be generated and used to incentivize LGUs cooperation and cover national co-financing share from 2021 onward.

Expected benefits: better waste management, a more resource- and energy- efficient economy; less waste and pollution; healthier environment and population, increased impact of EU funds.

Required Action:

1. Revise existing economic incentives, improve EPR scheme and introduce landfill tax

- a. Assessment should be made on the environmental fees and their efficiency
 - b. EPR schemes run by EPEEF should be revised and extended;
 - c. Incentives for creating economy of scale should be set
 - d. If not before, landfill tax should be introduced latest when transposing the new EU Waste Package (circular economy) due in June 2020; a phased approach should be considered.
2. Prepare regional waste master plans along with the business plans:
- a. The implementation of regional schemes should be supported by the central government
 - b. Facilitate cooperation of LGUs through different incentives schemes (implemented through a pilot project)
 - c. Build a pipeline of investments with the financing schemes based on regional needs
 - d. Introduce regional schemes in legislation, at the latest when transposing the new EU Waste Package (circular economy) due in June 2020.

Risk management

Potential risks	Mitigation measures
Poor coordination between different administrative levels would delay the implementation.	Set-up a special national implementation and coordination body with funding, capacity and authority to mediate and organize sector stakeholders.
LGUs and local communities not interested enough in waste management and circular economy.	Introduce incentive schemes, provide support in co-financing of investments.

4.2.2 Achieve fulfilment of Urban Wastewater Treatment Directive requirements and implement water utility reorganization and efficiency improvement process

Problem – Compliance with the EU Urban Wastewater Treatment Directive is urgent as Croatia has to ensure full compliance by 1 January 2024. Depending on the size of agglomeration and sensitivity of the receiving water, there are a number of interim deadlines for the construction/extension of the required systems:

- 31 December 2018: The interim target of 31 December 2018 for agglomerations with a population equivalent of more than 15,000 (47 agglomerations) has already passed and the target missed.
- 31 December 2020: The next interim deadline is 31 December 2020 for agglomerations with a population equivalent of more than 10,000 (26 agglomerations).
- 31 December 2023: Compliance in the remaining agglomerations needs to be ensured by the end of 2023 (208 agglomerations).

EU membership offers unique funding and development opportunities. However, a lack of adequate capacity for project preparation/implementation and the inability to secure sufficient funding at the local level are among the main bottlenecks inhibiting the accelerated implementation of the UWWTD required wastewater investments. During the remaining transitional period, Croatia will need to ensure that investment planning and implementation is managed in line with the specified deadlines and that necessary reforms in the sector - at the utility, municipality and national level - are successfully initiated and accomplished to ensure the available funding is absorbed, as well as to ensure UWWTD compliance and the sustainable and efficient operation of the newly developed infrastructure.

Current fragmented water service provision structure, lack human, technical and financial resources for successful absorption of EU funds, and latter operation and maintenance of newly developed infrastructure. Therefore, it is necessary to reform the sector through the aggregation of a large number of current small utilities into a smaller number of larger utilities, using the principle one service area-one supplier-one tariff. The main driving motivations behind this effort are the need to absorb EU funds more effectively and the need to cross-subsidize the operation of water, and particularly wastewater, systems into smaller settlements which find compliance with the new EU standards too expensive.

Approach – The water service provision sector is facing a double challenge of implementing the largest, EU-compliance-driven, investment cycle in its history, and at the same time, improving its technical and operational capacity and service provision efficiency. This needs to be resolved through water sector reorganization that will include: utility aggregation, capacity development and efficiency improvements at local level, and the improvement of the enabling environment at the national level.

Required actions

1. Implement a water utility reorganization process including utility aggregation, focused on efficiency improvement and capacity development (especially at the local and regional levels) to ensure the long-term sustainability of the sector. The main issues that need to be addressed with regard to improving water sector organization and efficiency are: (i) secure sufficient financial resources to cover EU compliance needs, (ii) secure project preparation and implementation capacity needed for EU compliance, (iii) implement utility sector reform (regionalization) to strengthen capacity and improve service efficiency, (iv) ensure affordability of future tariffs, (v) strengthen regulation in the water sector. Following two phases in this process could be identified:
 - a) Finalisation of legal framework for aggregation of water services With the first pack of legal documents already in parliament procedure, the second set of laws (including those responsible for defining boundaries and reforming the financing model) need to be completed, and adopted in the Parliament.
 - b) Restructuring and legal alignment of the water services provision sector with the new reform. The implementation of a utility aggregation process that is in line with the currently adopted legal framework, including through the establishment of a financing framework to support the reform implementation.
2. Strengthen capacity for project preparation and implementation of EU financed investments by centralizing a larger part of project preparation activities. Since capacity for project preparation and implementation at the local level is insufficient in a large number of utilities, and implementing the reform process will take time, it is necessary to strengthen the state's role (using and building on the capacity of Croatian Waters) in project preparation and in the implementation of EU processes, possibly through the establishment of a stronger Project Implementation Unit inside Croatian Waters that will have larger responsibility and resources than it currently does (using experience of similar previous projects like Adriatic Project)
3. Provide incentives for efficiency improvements of service provision through the establishment of an effective benchmarking system. The existing Croatian Waters' water utility benchmarking platform needs to be updated and turned into an effective benchmarking tool so as to allow for the tracking of utility performance, based on mandatory data reporting by utilities, and public access to utility performance data. This needs to be done in coordination with the national regulatory body so as to avoid the duplication of data collection.

4. Identification of priority EU compliance investment needs, with a focus on cost effectiveness and environmental impact. Better prioritization of investments is needed to maximize the impact of available resources on UWWTD compliance and WFD objective fulfillment. Priorities in project preparation and implementation should be made based on the investments' impact on the environment and their cost effectiveness. Decisions on project scope and treatment level should be focused on achieving cost effectiveness but take into consideration the environmental status of the receiving water.
5. Establish a financing platform (that could be accessed by water utilities) for co-financing EU funds and other investments needed for EU water directive compliance. Establishment of a national financing facility, accessible to all water utilities, for securing the water utility contribution (so called 'local component') for EU compliance investments. Such a facility would give utilities access to finance under more favorable conditions (interest rate and maturity) than they are able to obtain from the commercial banking sector.
6. Developing wastewater collection, treatment and disposal systems in line with UWWTD requirements. Continued implementation of UWWTD compliance activities, but with a focus on improved absorption of available EU funds, and better coordination among international, national and local stakeholders. Due to the nature of the marine environment and the importance of tourism for the economy, this measure is particularly important in coastal area, especially in zones of sensitive sea water quality.

The target Achievement of the objectives of the EU Urban Wastewater Treatment Directive (UWWTD), and reorganization of the sector's structure, with the objective of improving the water service sector's efficiency and sustainability.

Resources needed: Significant investments are needed. The costs of UWWTD compliance have been estimated to be €3.2 billion. Thus far, Croatia has approved €1.8 billion for projects in meeting the UWWTD, €1.4 billion of which are eligible for EU funds, but of which only €1.1 billion is available in the current EU Operational Programme, Competitiveness and Cohesion (OPCC) for the period 2014 – 2020.

Expected benefits: (i) cleaner environment and healthier population, (ii) efficient and sustainable water service provision, (iii) reduced tariff increases due to improved efficiency of water service provision

Risks management

Potential risks	Mitigation measures
Lack/insufficient political will to endorse critical sectoral reforms, and pressure to speed up the implementation of the UWWTD.	Engagement of EC, and media pressure on key political actors, stressing potential EC infringement and financial fines.
Slow mobilization of institutions and other stakeholders responsible for implementation.	Set-up a national coordination body for the mobilization of institutions and other stakeholders.
LGUs and local communities not interested enough in water management-related investments.	Information campaigns showing necessity and benefits of sound water management. MEPE to provide toolkits/models for implementation by LGUs, with technical and financial support.

4.3 Medium-term policy recommendations (5-7 years)

4.3.1 Ensure provision of reliable and safe water supply for the entire population and economy; develop irrigation schemes for inclusive growth; ensure protection of people and assets against floods and other adverse effects of water

Problem: While at the national level, Croatia is endowed with relatively abundant water resources, changing trends with regards to water availability, water usage, water quality, as well as the status of water service infrastructure indicate that medium-term policies are required to proactively manage the country's water assets so as to ensure they can continue to be leveraged for Croatia's people, its economy and its environmental resilience.

Delivering services: coverage of water services is high, but the supply network needs rehabilitation and upgrading. The average age of water pipes is more than 40 years, and the system suffers from maintenance backlogs. This poses a threat to water security through high water losses which undermine the financial sustainability of the system, both in terms of increased cost of production and as a result of forgone revenues. In areas where water scarcity is a challenge, non-revenue water (NRW) poses additional challenges to already constrained supply. Aggravated by climate change, there is a potential issue regarding the reliability of water supply services, in particular in coastal areas with large seasonal demand growth due to tourism.

The vitality of irrigated agriculture in Croatia has been progressively declining over the past decade, hampered by institutional weaknesses, small farm sizes, dilapidated agricultural extension services, and an aging farmer population. The country has one of the lowest ratios of irrigated-to-irrigable land in the region: only 22,500 ha are currently irrigated out of 484,026 irrigable ha. Efforts to extend the irrigation and intensify agricultural production need to be aligned, taking into consideration the water demand of different users and the need to reduce and manage water pollution from agricultural sources.

The Water Framework Directive (WFD) provides the framework for the protection and improvement of surface and ground water, and Flood Directive (FD) for the sustainable management of risks stemming from flooding. The default deadline for the achievement of good status of water bodies as required by the WFD is 2015, however, with the possibility of applying time-extensions for two 6-years planning cycles. Hence, the ultimate deadline for the achievement of good status under the current legal framework is 2027. The necessary remaining measures must be included in the 3rd River Basin Management Plan (RBMP), which is due by December 2021 and will address the planning period 2021-2027.

Climate change impacts will be felt through more frequent or more severe extreme weather events, including floods and droughts. Tourism growth in water scarce areas along the coast and during the dry summer months will continue to challenge the viability of having sustainable high-quality services year-round. Climate change exacerbates the threat of hydro-meteorological hazards, with about 15 percent of the country estimated to be flood-prone (mainly within the Danube drainage basin). Historical records by themselves may no longer be a reliable guide, and in the presence of uncertainty these strengthen the need for a more systematic, comprehensive, and resilient approach to water management.

Approach – Prepare and implement a coordinated set of actions to improve water management, water service provision and the mitigation of water-related risks in the country, building upon consensus on direction of water resource sector development and objectives of Eu directives.

Required actions

1. Review water security and the reliability of water supply, with an emphasis on the sustainable development of tourism and other important economic sectors, and the preparation of a plan for adaptation to climate change. This analysis would lead to the identification of sectoral vulnerabilities, and the preparation of mitigation actions and plans, improving the reliability and safety of water supply provision through a coordinated set of structural changes and targeted investments in critical elements of the water supply system, with emphasis on the coastal zone.
2. Develop a program of the activities needed to be in compliance with EU Water Framework Directive (WFD) and EU Floods Directive (FD), including support in strategic WFD and FD planning and implementation, and as well:
 - a) Preparation and implementation of 2021 River Basin Management Plans (RBMP) and Flood Risk Management Plans (FRMP) and pre-preparatory engagement on the fourth cycle of Plans (2027): preparation and implementing the third cycle of RBMPs and second cycle of FRMPs, with a focus on ensuring alignment with international best practice in areas of identified weaknesses, and expanded cooperation with neighboring countries in all shared catchments. Identifying gaps in the previous cycle of RBMPs and FRMPs regarding climate change, understanding and planning for associated risks.
 - b) Preparation and revision of existing multi-annual programs for construction of regulation and protection of water and amelioration facilities. This activity includes a revision of the existing plans based on more recent data and taking into consideration climate change impacts, as well as the preparation of the new plans in line with those prepared by RBMP and FRMP.
 - c) Flood risk management Financing Strategy Analysis of FD from a financial standpoint, including assessing the level of financial acceptable risk, and interpreting the Cost Benefits Analysis of non-structural measures and restoration measures and the related evaluation of eco-system services.
3. Overcoming irrigation constraints would involve notably (i) the repair, modernization and expansion of the on-farm irrigation facilities, (ii) the more secure provision of bulk water in the summer season and the drainage of surplus water in the wetter seasons, and (iii) the strengthening of institutions responsible for sustainable water management and increased productivity of irrigated agriculture, including the use of land consolidation as a tool to improve efficiency and implement environmental and rural development policies. The implementation of the updated National Irrigation Strategy and the development of water user associations (WUAs) should be supported.
4. Prepare and implement plan for reducing nitrogen and phosphorous discharge into the aquatic environment (part of the Nitrate Directive Action Plan). Start with demo projects for reducing N and P discharge into water from agriculture (eutrophication). Consider taxing N and P fertilizers.

The target Achieve the objectives of the WFD, UWWTD, Drinking Water Directive (DWD) and secure efficient, sustainable and affordable water service provision for the population and the economy. Achieve the objective of FD, reduce water related damages of extreme weather events, ensure safety for the people and economy. Secure water for the development of modern, rainfall independent and competitive agriculture. Fully ensure the utilization of river basin and flood risk management plans as appropriate planning instruments.

Resources needed: Significant investments will be needed (several hundred million EUR) for projects on (i) water supply system modernization and non-revenue water reduction, (ii) integrated flood protection planning and improvement of water body status; and (iii) public irrigation systems. While

EU Cohesion Funds will cover an important part of the investments needs, a considerable financial gap will have to be covered by tariffs and transfers.

Expected benefits: (i) secured water supply and environment for economic development and tourism; (ii) sustainable economic development and growth (tourism, agriculture, urban development, etc.), and (iii) secure and sustainable urban development.

Risks management

Potential risks	Mitigation measures
Lack/insufficient commitment at government and operational level to tackle longer term water service provision issues.	Endorsement by political and sectoral decision makers, and a media awareness campaign stressing the risks and importance of undertaking actions now so as to avoid much bigger problems in the future.
Lack of adequate financing dedicated to the mitigation of climate change impacts. Lack of effective regional cooperation and coordination in flood protection.	Strengthening the role of existing regional coordination bodies (Sava and Danube river commissions) through active participation, allocating more responsibility and increasing their financial means. Strengthening disaster risk mitigation financing mechanisms.
Lack of willingness from agricultural sector to participate in irrigation development programs.	Government (national and regional) irrigation promotion programs, coordinated with adequate subsidies and a longer-term production agreement to incentivize farmers to participate.
Environmental impacts and potential competing interests amongst different water users due to technical flood protection measures and increased utilization of extended agricultural irrigation.	Full utilization of coordinated river basin and flood risk management plans as planning instruments and to avoid the deterioration of water status.

4.3.2 Reduce air pollution and greenhouse gas emissions and make Croatia more climate resilient

Problem – A significant fraction of the Croatian population in urban areas continues to be exposed to PM_{2.5} concentration levels that are higher than levels considered to be safe for human health. The use of biofuels by households, open burning of agricultural waste, and to a lesser extend municipal waste, is still being practiced in suburban areas, contributing to elevated pollution levels. Agriculture is also a source of significant ammonia emissions. Croatia is likely to receive a considerable amount of trans-boundary air pollution. However, there are no reliable information on the quantity and type of trans-boundary air pollutants affecting Croatia. Air pollution is a major risk to health, and also acidifies the environment, leading to economic damages in agriculture, forestry and other sectors.

Relatedly, the economy remains carbon intensive. The sectors that are the biggest contributors to greenhouse gas emissions also are the largest contributors to air pollution, creating the potential for synergies between efforts and measures that address climate change and those targeting the improvement of air quality. There are many “no regrets” mitigation measures that are cost effective and economically beneficial to Croatia. Most of these are related to energy efficiency, green cities and the circular economy; these are measures that will also significantly contribute to better air quality and reduce greenhouse gas emissions.

Importantly, Croatia needs to become more climate resilient and better prepared to handle climate-related risks and disasters, such as droughts, urban floods, storm damages and wildfires. Among these,

wildfire occurs most frequently, notably on the coastal areas. It contributes to environmental degradation, low air quality, increased run off, landslides as well as decreasing tourism, damaging assets and costing lives.

Approach – Incentivize the adoption of cleaner production processes – improved stoves or cleaner fuels. As much as 73% PM_{2.5} emissions originate from combustion in non-industrial furnaces. It is therefore essential to improve the combustion of fuels used in these operations by promoting improved biomass stoves and/or replacing solid fuels (wood and coal) with more environmentally friendly or cleaner fuels. Household heating systems and energy plants for street blocks or large buildings should be the prime targets for this action. Air pollutants emission reduction measures should also target the transport sector, because transport is the most significant source of NO_x emissions (43%) and the second largest source of PM_{2.5} emissions (8%)³⁴. Enforcement of legislation regarding waste management (including) illegal burning of agricultural waste should be improved. Those measures will reduce PM levels on the suburban and regional scale. LGUs that are in non-compliance with air quality standards have to continue improving their air quality monitoring plans and emission reduction measures. To be able to do so, their capacities need to be strengthened through a capacity building and technical assistance programme. The problem of transboundary air pollution needs to be put higher on political agenda. Capacities for coping with climate change and increasing resilience need to be strengthened as well, at both national and local levels.

The target should be to (i) meet the EU objectives and air quality limit values as per the Clean Air Policy Package – as well as the Ambient Air Quality Directives, the National Emission Ceilings Directives and the source legislation underpinning them; to (ii) prepare Croatia to become more climate resilient and better handle disasters.

Resources needed: approximately 1 billion EUR.

Expected benefits: a healthier population and environment; compliance with the EU Clean Air Policy Package; reduced carbon intensity and greenhouse gas emissions.

Required actions

1. Reduce air pollution and carbon emissions from non-industrial furnaces by improving combustion. Develop programs and incentives to promote purchase of improved biomass and/or replacement of solid fuels with more environmentally friendly fuels or cleaner fuels. Convert residential heating to gas and other alternative fuels (e.g. biomass pellets) and invest in the efficient and clean district heating as well as gas networks. Provide financial support and economic incentives for the renewal of heating appliances to help poorer households convert to clean stoves (following Eco-Design Regulations requirements). For rural households, financial support can be provided through the Rural Development Programme⁷.
2. Reduce air pollution and carbon emissions from the transport sector – The Environmental Protection and Energy Efficiency Fund is already co-financing the purchase of electric, plug-in hybrid and hybrid vehicles for citizens, companies and public organisations, as well as providing eco-driving training. Public transport plans in larger cities should be further improved and supported

⁷ The funding available under the Rural Development Programme (RDP) is currently underutilized. Investments in cleaner stoves would not just increase the absorption of the RDP funds, but also help Croatia to reach the target of 30% investments in “green measures”. Due to the new rules, the later will be a great challenge for Croatia in the next programming period.

through environmentally friendly solutions. “Low-emission zones” and incentives to renew vehicle fleet are among other measures.

3. Strengthen the enforcement of legislation that impacts air quality.
4. Reduce ammonia and other air emissions from agriculture by applying stricter legislation, implementing demonstration projects and by providing incentives for the implementation of abatement measures. The adoption of low ammonia emission practices in agriculture can be stimulated by providing incentives from the agri-environment measures of the Rural Development Programme. Investment grants and/or payments per hectare or livestock unit can be provided for preparing nutrient balance in the application of fertilisers and manure, specific controls on manure management and other provisions for inorganic fertilisers. Many of these measures will also help reduce emissions of nitrous oxide, a potent greenhouse gas.
5. Strengthen LGUs’ capacity so that they can successfully implement air emission reduction measures by providing them with high-quality consultancy services that could assist them in their obligations.
6. Make an inventory of the quantity of air pollution received as a result of transboundary emissions and assess the related damage, preferably by monetizing the damage.
7. Initiate an international action aiming at reducing transboundary air pollution from the Western Balkans power plants.
8. Implement an awareness raising program of experts involved in tourism, agriculture, fisheries, energy spatial planning and other sectors on the possibilities of adaptation to climate change.
9. Strengthen human and technical capacities for implementing research and applied activities in the area of climate modelling, analysis, and interpretation of observed and expected climatic changes.
10. Develop impact indicators on the implementation of the adaptation strategy for vulnerable sectors and society.
11. Establish a climate monitoring and early warning system for protected areas and ecological network and monitoring of protected wild habitat types and wild species.
12. Establish a system for calculating health-economic indicators for climate change-related conditions.
13. Expand the Croatian Platform for Disaster Risk Reduction to include climate change-related indicators for the development of an early warning system.
14. Strengthen the capacity for the implementation of non-structural measures for protection from flood and drought in case of extreme hydrological conditions (whose increase in intensity and frequency of occurrence is conditioned by climate change).
15. Enhance and modernize civil protection and fire response service.
16. Strengthen the capacities to assess dangers and responses during disasters, major accidents, extraordinary events or incidents/crisis situations related to climate change.
17. Strengthen the capacities for effects of the sea on the coastal water-communal infrastructure and coastal water resources in conditions of sea level rise caused by climate change.

Risks management

Potential risks	Mitigation measures
Lack/insufficient political will and pressure to implement EU targets on clean air and become more climate resilient.	Media pressure on key political actors, stressing potential EC infringement risks and financial fines.

Potential risks	Mitigation measures
LGUs and local communities not interested enough in air protection and becoming more climate resilient.	Information campaigns highlighting the necessity and benefits of clean air and adaptation to climate change. MEPE to provide toolkits/models for implementation by LGUs, with technical and financial support.

4.4 Medium-term policy recommendations (5-7 years)

4.4.1 Provide an impetus for green spatial planning and the creation of green cities

Problem – Croatia is yet to develop a green city policy that clearly articulates how urban areas will combat climate change, manage solid waste, reduce their GHG emissions and other air pollution causes, increase green spaces, improve biodiversity and manage wastewater and storm water in their spatial planning designs. Croatia also needs to secure financing for the implementation of the green cities concept. It also needs to better integrate green city elements in spatial planning and in the designing plans of urban areas.

Approach – The proposed policy would aim to improve urban and spatial planning approaches and capacities of municipalities for integrated planning. The starting point should be establishment of the National Sustainable Cities Framework with well-defined green city indicators. The next step is to initiate preparation of a set of strategies and programs facilitating a greener spatial planning and implementation of technical and environmental solutions that will reduce pollution, enlarge green spaces, make cities more climate resilient and improve ecosystem services in urban areas. A range of solutions suitable for green cities can be applied and tested in Croatia’s urban areas. Croatian spatial planners have already identified a few windows of opportunity. Some elements of green cities could be relatively easily built and tested in permanently or temporarily deserted and often devastated urban areas (e.g. urban network of public areas devastated through illegal construction, former harbors or industrial and military sites). Many of these are owned by the State or LGUs, so it would be feasible to expect a relatively easy concerted action between the key stakeholders and spatial planners. Linked to improvements in spatial and urban planning, the policy should aim at introducing advances in municipal asset management, municipal finance self-assessments, and capital investment planning at municipal level. The policy would also address the problem of managing declining and aging populations in cities by offering a smart decline strategy. Another area of intervention is the revision to building codes, especially for existing buildings (which will need to be in place by 2020 considering EU plans in this direction). A vacant and derelict land and building survey would help to prepare a national strategy for capturing value from under-used/abandoned land, building, and industrial complexes. The policy would also address the critical issues related to urban resilience to reduce exposure to flood, storm, wildfire, drought and seismic risk.

The target is to build capacities and prepare program and strategies facilitating implementation of green cities concept in practice.

Resources needed: relatively low cost to government, approximately 10 million EUR. However, substantial investments will be needed by the LGUs to implement green city measures (see the flagship project on green cities).

Expected benefits: smart, climate-resilient, environmentally friendly urban areas which are pleasant places to live in and which are attractive to tourists.

Required actions

1. Implement a robust capacity building program aiming to improve urban and spatial planning approaches for integrated planning.
2. Prepare a Sustainable Cities Framework and indicator system including national standards, guidelines and indicators for green urban infrastructure and circular economy approaches in urban areas.
3. Revise building codes, especially for existing buildings.
4. Establish a vacant and derelict land and building survey. Prepare a strategy for capturing value from under-used/abandoned land, building, and industrial complexes.
5. Prepare Strategic Brownfield Redevelopment Planning in key cities including a study on the demand for real estate development that assesses the macroeconomic environment that is impacting the real estate market and use this to guide urban development and prioritize assets for release.
6. Prepare a programme for managing the declining and aging populations in cities and towns including approaches to consolidating or densifying urban form, managing municipal service provision, and elderly care services– a smart decline strategy.
7. Prepare Sustainable Redevelopment Strategies for Specific Priority Sites. Redevelopment strategies for these sites would vary in complexity and would need to consider stakeholders, market viability, infrastructure requirements, development size, etc.
8. Prepare new flood maps for the next iteration of the flood directive and provide capacity development and support to prioritize and oversight flood management projects.
9. Modernize hydro-met and early warning services, particularly for wildfire management and enhanced early warning for flood, drought and fire.
10. Evaluate socio-economic and environmental impacts of green city pilot projects.

Risks management

Potential risks	Mitigation measures
Politicians, spatial planning experts and general public not interested or educated enough about the benefits of the green cities concept.	Information/media campaigns showing necessity and benefits of green cities.
Consensus about the shared vision and green city measures to be implemented difficult to reach.	Skilled facilitators and opinion leaders to lead the process.
Insufficient co-operation between spatial planners and other stakeholders.	Regular meetings, round tables, exchange of ideas; full transparency of the process.

4.4.2 Enhance management of nature protected areas and Natura 2000 network

Problem – In order to better protect its nature protected areas and reap the economic benefits arising from tourism, Croatia needs to further strengthen the management of its protected areas. These must be at the same time protected from unsustainable tourism practices. Given that the 2018 Environmental indicator report suggests that the EU has achieved positive or stable trends on most indicators, except for 3 indicators related to biodiversity implies nature protection also needs to be embedded into sectoral policies, and markets for ecosystem services created to improve the financial sustainability of Natura 2000 network. The shift is needed from “do not harm” attitude to “do better” to focus on sustainability.

Approach – Policy and capacity development. Croatia has a very comprehensive Nature Protection Strategy and Action Plan for the period 2017-2025, with well formulated strategic goals, specific objectives and activities. These should be fully implemented. All nature protected areas should revise and improve their management plans so that these adequately address the conservation of Natura 2000 species/habitat types. Significant efforts and implementation mechanisms need to be developed to ensure integration into sectoral policies.

Resources needed: the sustainable development of tourism in nature protected areas requires substantial resources, probably in the range of several hundred million EUR.

Expected benefits: diverse and well protected nature; economically viable protected areas of nature with a larger employment of local population; a well-managed Natura 2000 network.

Required actions

1. Continue with the implementation of activities stipulated in the Nature Protection Strategy and Action Plan.
2. Prepare and implement a management plan complying with Natura 2000 requirements and a visitors' plan for each nature protected area, aiming at diversifying tourist offerings.
3. Strengthen the capacities of nature protection system and other stakeholders by developing and providing continuous capacity building to the staff, guides and other people working in protected areas of nature, as well as to stakeholders and general public. Employ more people in the nature protection sector, notably in the administration dealing with the issuance of licenses for undertaking alterations in Natura 2000 sites.
4. Strengthen cooperation with other sectors, through policy change or implementation mechanism that should implement nature protection strategies through planning documents and sectoral strategies and ensure that nature protection is fully integrated into relevant sectoral strategies. Both public and private sectors, as well as the general public should understand that nature/ecosystems are not an obstacle to growth, but rather a basis for sustainable growth. Economic sectors should not just align their obligations with the obligations of SEAs, EIAs and ENIA, but also take care that there are no negative effects on the nature/ecosystems. They should go a step further and seek to embrace and implement nature-based solutions aiming at achieving both economic prosperity and a positive effect on nature/ecosystems.
5. Secure financing for managing Natura 2000 network. Make a deal with relevant authorities and secure a fixed amount of Emission Trading Scheme units to finance the management of Natura 2000 network.

Risks management

Potential risks	Mitigation measures
Management of nature protected areas not competent and not interested in the above actions.	High-quality, motivating capacity building and technical assistance programs run by inspiring and competent consultants.
Too few ETS units issued to nature protection sector, majority given to big gas or electricity companies.	Lobbying at the highest policy making levels and centers of political power; preparation of cost-benefit analyses showing economic benefits of having a well-managed Natura 2000 network.

4.4.3 Enhance a multi-sectoral approach to integrated protection and management of the marine environment and coastal areas

Problem – Croatia does not sufficiently support the implementation of integrated protection and management of the marine environment and coastal areas. The integration of spatial and economic planning as well as environmental, nature and cultural heritage protection in the coastal zone and marine environment is insufficient. This is largely due to the lack of information and inadequate technical and institutional capacities, which prevent the concerted action required to implement the integrated protection and management of the marine environment and coastal zone.

Approach – Croatia already has a comprehensive Programme of Measures for the Protection and Management of the Marine Environment and Coastal Zone³⁰, with well formulated strategic priorities, specific objectives and measures. But it is important to ensure that these are implemented in practice, as well as that the key provisions of the laws relating to the environmental protection, physical planning, construction, fisheries and other maritime issues are in line with the provisions of the Programme.

Resources needed: approximately 5-10 million EUR.

Expected benefits: a well-managed and protected marine environment and coastal zone offers a range of economic (notably in tourism and fisheries sectors), environmental and socio-cultural benefits. It provides opportunities for the employment of the local population and improves its livelihood.

Required actions

1. Provide appropriate institutional settings for the co-ordination, monitoring and evaluation of the implementation of integrated protection and management approaches of the marine environment and coastal zone.
2. Develop a set of indicators for monitoring the sustainability of the integrated protection and management of the marine environment and coastal zone.
3. Strengthen the capacities of relevant stakeholders by developing and providing continuous capacity building to the experts and general public.
4. Strengthen cooperation with other sectors that should implement integrated protection and management of the marine environment and coastal zone and ensure that this approach is fully integrated into relevant sectoral policies.

Risks management

Potential risks	Mitigation measures
Lack of interest to implement integrated protection and management of the marine environment and coastal zone in practice.	Capacity building and information programs providing information about the benefits of integrated protection and management of the marine environment and coastal zone.
Implementation of integrated protection and management of the marine environment and coastal zone management is difficult because of insufficient integration in, and sectoral coordination between, environmental protection, physical planning, construction, fisheries and other maritime issues.	Well-functioning institutional settings and procedures allowing for monitoring and evaluation about how successful the integrated protection and management of the marine environment and coastal zone management is incorporated in sectoral policies and implemented in practice.

4.5 Long-term policy recommendations (8-10 years)

4.5.1 Build a modern and thriving water sector that supports Croatia’s economic growth and inclusive development and protects its environmental assets for all

Problem –Long-term policy has the potential to transform and spark a new innovation agenda for the water sector in Croatia. However, harnessing the global opportunities of innovation and technology as well as proactively managing climate risks will require a forward-looking, productive sector with strong modern institutions, efficient provision of services and sustained and protected water assets. Building on the short and medium-term policy recommendations, this will require a rejuvenation of the country’s water sector planning and institutions to manage and price water services, align incentives for productive and efficient water service institutions, catalyze investment, and protect water assets.

Approach – A set of coordinated long term measures at the national and local level aiming to create and maintain sustainable and affordable water services, ensuring the sustainable fulfilment of WFD water status requirements.

Required actions

1. Align and strengthen incentives encouraging the modernization of WSS service providers toward operational and financial sustainability, good practices and productivity. Strengthen utilities’ financial viability to ensure sustainability and access to financial markets through regulations, sector reorganization and performance incentives. This would include gradual pricing of water and its associated services to reflect the economic value of the resource.
2. Leverage Croatia’s natural water assets even more actively to support economic growth. Improvement of surface water status quality as a result of better wastewater treatment, better management of pollution by non-point sources and gradual implementation of hydromorphological restoration measures, will enable Croatia to continue to leverage these assets for tourism, agriculture and ecosystem benefits.

The target Secure long term operationally sustainable and affordable water service provision for the population and economy.

Resources needed: Smaller than in the previous period but still significant investments will continue to be needed (amounting to several hundred million EUR) for continued infrastructure upgrading. The role of the EU Cohesion Funds in covering these investments needs is expected to be significantly lower than in the short and medium term or eliminated altogether, suggesting that financing will have to be covered through tariffs and transfers, and further leverage and sustain the water assets of the country.

Expected benefits: (i) a cleaner environment and healthier population; and (ii) economic development and growth (tourism, agriculture, urban development, etc.).

Risks management

Potential risks	Mitigation measures
Lack of political commitment to secure funding for sustainable long-term service provision.	Engagement of national policy and regulatory bodies to enforce sufficient tariff levels so as to ensure total cost recovery.

Potential risks	Mitigation measures
Insufficient public awareness of status/efforts and importance of achieving good water quality status, resulting in a lack of pressure on policy makers at higher governance levels.	Continued media action, more prominent role of environment education in schools, and strengthening of civil society and NGOs.
Agricultural sector not incentivized to reduce nutrient discharge.	Pressures from the EC and national government, combined with the establishment of a financial incentives scheme aimed at reducing fertilizer use in selected areas.

4.5.2 Provide impetus for transition to a circular economy

Problem – Croatia profiles, and in a way brands itself as the “Green Croatia” and “Visible Croatia” – a country of unspoiled environment and beautiful nature. Because of this, it is even more important that Croatia boosts its environmental policy. Croatia has a suboptimal waste and wastewater management and runs quite an intensive carbon economy.

Approach – It is proposed to design a long-term (10 year) program supporting the adoption of a circular economy in Croatia. The program is built on a concerted action plan for the development of a circular economy. The approach seeks to integrate waste management, energy, climate change, building management and other policies into an overall grand strategy. The cross sectoral approach to this topic is limited. In addition to separate collection of waste that presents a foundation for circular economy, involvement of private sector, entrepreneurs, R&D should be included. Focus should be extended from recycling to design and production as well as consumption.

The target should be the introduction of a set of sound legislative, economic and informative instruments enabling the adoption of a circular economy in Croatia.

Resources needed: considerable costs to government and business sector. Approximately 1 billion EUR.

Expected benefits: more resource and energy efficient economy; less waste and pollution; healthier environment and population.

Required actions

1. Preparation of an action plan for circular economy comprising a set of regulatory, economic and informative policy instruments.
2. Setting-up institutional arrangements enabling a sound implementation of the action plan.
3. Secure financing for the implementation of the action plan.
4. Implement the action plan for a circular economy.
5. Monitoring and evaluation of the implementation of the action plan for circular economy.

Risks management

Potential risks	Mitigation measures
Politicians, administration, scientists, media and general public not interested enough in circular economy.	Information/media campaigns showing necessity and benefits of introducing a circular economy.

Potential risks	Mitigation measures
Stakeholders not interested in training and other awareness raising programs on circular economy.	High-quality, motivating capacity building and technical assistance programs run by inspiring and competent consultants.

5 Cross-cutting issues and their implications for policy

Environmental issues are inherently cross-cutting. Natural capital produces goods and services that benefit a range of sectors such as agriculture, forestry, energy, tourism, etc. Environmental impacts are often the result of economic activity in different sectors (**Table 4**). Examples abound. Air pollution is the result of emissions from energy and transport sectors, as are greenhouse gas emissions. One of the many causes of water pollution is run off from the agriculture sector. In addition, disaster and climate change impacts are affecting a range of economic sectors, and these sectors need to adapt to avoid and minimize climate impacts. As a result, though sector-specific interventions are needed, and many of these are outlined in section 4, cross-cutting issues also require interventions that cut across sectors.

Table 4. Environmental policy: key environmental issues and cross-cutting sectors

Environmental issue	Cross-cutting sectors
Nature protection	Agriculture; Forestry; Tourism; Water management
Water management	Industry; Agriculture; Urban; Nature protection (nature-based solutions);
Waste management	Household; Industry; Service sector;
PM _{2.5} -based air pollution	Energy; Transport; Agriculture (because of ammonia – precursor gas for secondary PM)
Ammonia-based air pollution	Agriculture
Green cities	Spatial planning; Energy; Transport; Agriculture (urban farming); Nature protection
Climate change and Disasters	Energy; Transport; Agriculture; Forestry; Industry; Tourism

Environmental policies and measures need to be better integrated into sectoral policies. Given that sectors impact the environment, and that the environment impacts sectors, successful implementation of any environmental policy largely depends on its integration in sectoral policies. The coordination and planning for environmental policy measures rests with the Ministry of Environmental Protection and Energy (MEPE), however, the implementation of measures to address environmental issues requires support from other sectors. This is true for tackling air pollution and for climate change mitigation and adaptation. Non-industrial energy production and transport are the two largest sources of air pollution and a significant source of greenhouse gas emissions. While the MEPE can set standards for air quality and establish targets for reductions in greenhouse gas emissions, policies and programs in the energy and transport sector will be needed to tackle air pollution and reduce emissions. Similarly, sector-specific strategies and programs will be needed for the sectors to adapt to climate change and to be climate resilient.

Nature-based solutions can provide viable alternatives for tackling a range of environmental challenges, such as air pollution, climate change, water security, water pollution, etc. These solutions are cost-effective and simultaneously provide environmental and social benefits. Green roofs or walls in urban areas can be used to moderate the impact of high temperatures, capture storm water, abate air pollution, and act as carbon sinks, while enhancing biodiversity. Flood risks can be reduced through designating and managing retention areas and by increasing water holding capacity (by building humus) of the agricultural and other soil. Yet these solutions are rarely integrated into sector strategies.

Box 1. Opportunities for integration of environmental policies – the case of agriculture sector

The agriculture sector is a good example of how environmental policies and measures can be integrated into a sectoral policy. The integration of the following environmental aspects can reinforce the agricultural policy:

- **Air pollution** – Croatia does not meet the ammonia emission ceiling set by the National Emission Ceilings (NEC) Directive. Agriculture emits nearly 85% of total ammonia emission and is the prime sector that needs to be addressed in order to tackle the issue. Agricultural policy could introduce a specific program or a set of measures tackling the reduction of ammonia emission.
- **Climate change mitigation and adaptation**– agriculture is a sector that is hit by climate change more than any other sector. In addition, agriculture is also a source of climate change. A set of agriculture-specific mitigation and adaptation measures could be developed and promoted among the farming community. For example, introducing specific measures and incentives for promoting carbon sequestration in the soil within the Rural Development Program Measure 10, could be a good start.
- **Water protection** – Croatia is one of the worst performers in terms of the eutrophication of surface water within the EU. It is caused by excessive concentration of nitrogen and phosphorous, which nearly entirely originate from agriculture. Agricultural policy could tackle this problem by designating more areas (or the whole country as many MS did) as Nitrate Vulnerable Zones (currently it covers only approximately 5% of utilized agricultural land). The Action Program for reducing nitrates could prescribe more stringent maximum admissible N rates (the current rates for some crops are as twice as high as for instance in the Netherlands – the EU country with the highest crop yields).
- **Nature protection** – Agriculture is particularly important for biodiversity preservation; in 2014, Croatia’s agricultural land accounted for 26% of the country’s Natura 2000 network, which is higher than in any other EU MS⁷. MoA could exclude nitrogen-fixing widely spaced row crops, notably soya from being an Ecological Focus Areas (EFAs) option, because these crops are detrimental to biodiversity and tend to pollute water. This was already recommended by MEPE in 2014, based on the analysis^{63,64} from a WB-funded project.

Sector-specific notes for transport, energy, and agriculture, outline policies that will be needed to address environmental impacts, to make the sectors less carbon-intensive and to adapt to climate impacts (see Tables 5 and 6). But cross-sectoral interventions will also be needed. For example, to ensure that adaptation needs are integrated into specific sector investments and strategies, a number of measures will need to be implemented, including:

- Strengthening coordination mechanism for Inter-Sectoral Coordination Commission for Policy and Measures for Climate Change Mitigation and Adaptation (CCCCMA) by elevating its stature. Consider, for example, PM as chair of the Commission.
- Linking sector finance to conditions requiring that the sector strategies and programs have been climate proofed. Develop and institutionalize a mechanism for ensuring that climate risks are being assessed and that climate screening is being done.
- Integrating the adaptation measures into the spatial planning system.
- Creating a national adaptation plan for coastal zones (currently only one county has it), which are particularly vulnerable to climate change impacts, along with sector-specific strategies.
- Strengthening the research and management capacities to assess the occurrence and risk of adverse impacts of climate change and adaptation.

Table 5. Sector-specific strategies to reduce greenhouse gas emissions (Source: Policy Notes on transport and energy sectors):

Transport	The primary mechanism by which Croatia can achieve emissions reduction in the transport sector in the near and medium-term future is to shift transport away from road-based modes. Potential investments include (i) expanded and enhanced suburban railway services in Zagreb and
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	Split; (ii) development of railways connectivity at the port of Rijeka and inland between Škrljevo and Ogulin to facilitate access to the RH2 corridor; and (iii) development of an electric mobility industry cluster around Croatia's domestic electric mobility champion (Rimac Automobili).
Energy	Croatia has prepared the Low Carbon Strategy and is updating the Energy Strategy. Together these will lead to the formulation of the National Energy and Climate Change Action Plan (NECCAP). There is a clear and urgent need for the rehabilitation of buildings to promote energy efficiency . Croatia should prioritize categories of buildings to be rehabilitated, which could be facilitated through a cost-benefit study. E.g. Croatia might consider whether to prioritize the renovation of buildings, publicly owned buildings in the city of Zagreb, and privately-owned hotels located mainly on the Adriatic coast. In addition, Croatia must focus on EE/EI in transport , including preparing for the expected increase in electrification of road transport and expanding rail and water transport alternatives. Measures to promote energy efficiency in poor households are still needed, particularly through improving residential building insulation, replacing electric appliances and heating/cooking biomass stoves (with added benefits of improving indoor air quality). This entails working with vulnerable homeowners to ensure that efficiency is improved. On the supply side, Croatia must move ahead with adding state of the art combined-cycle gas turbines and increasing efficiency of district heating.

Table 6. Making agriculture more climate resilient in Croatia (Source: Policy Note on Bioeconomy)

Practices promoted under organic and climate-smart production systems can deliver important environmental benefits, while strengthening climate resilience. Organic and climate-smart production, which systematically integrates climate change concerns in the planning and development of sustainable agricultural, fisheries, and aquaculture production systems, offers a variety of environmental benefits and can be an important part of a suite of strategies to improve the resilience of the agri-food system in Croatia. In particular, agricultural practices such as crop rotations, conservation tillage, cover cropping, composting, and integrated pest and weed management have widely demonstrated positive impacts on environment and climate resiliency in the form of improved soil quality and ecosystem services, and ground and surface water. Additionally, risk management or risk transfer instruments such as index-based insurance can help manage residual climate risks.

Mainstreaming climate change concerns in agri-food sector policies and programs encompasses: **(i) Analytics:** areas and sub-sectors vulnerable to climate change must be identified and needs and opportunities must be assessed for changing crops, species/varieties, and practices in response to climate trends; **(ii) Planning and Budgeting:** climate adaptation and mitigation measures focused on addressing key vulnerabilities, needs, and opportunities must be integrated in national and EU-funded support programs for the agri-food sector **(iii) Implementation and Monitoring:** participatory development approaches must be leveraged to effectively coordinate and implement climate change adaptation and mitigation actions involving public, private, and civil society actors in key production landscapes and territories, while implementation progress must be monitored and evaluated in line with CAP and CFP/IMF reporting requirements.

6 Proposed implementation roadmap

6.1 Protect, Conserve and Enhance Natural Capital

Roadmap for speeding-up progress on improving waste management

Starting from	Sub-actions	Responsible organizations
T ₀ + 6 months	<ul style="list-style-type: none"> • Prepare a functional review of waste sector; • Focus policy reform on: a) the alignment with the new EU circular economy waste package; b) the allocation of funds under the new Operating Programme 2021-2027 shifting from dealing with residual waste to separate collection and recycling; and c) strengthening the regulatory framework with new oversight and incentives (introduce landfill tax and other economic incentives for separate collection). 	MEPE, Environmental Protection and Energy Efficiency Fund (EPEEF)
	<ul style="list-style-type: none"> • Focus on the development of regional waste management schemes with business plans, enable internal and external staffing, which enables shift the focus from landfilling to separate collection and creating economy of scale for circular economy • Form a coalition of Local Government Units (LGUs) to participate in regional schemes. • Prepare a communication strategy with all stakeholders. • Decide on piloting region (suggestion: counties of Slavonia). 	MEPE, EPEEF, Government, Regional Government Units (RGUs), LGUs and private sector
Next 12 months	<ul style="list-style-type: none"> • Develop a circular economy action plan. • Develop and implement strategies for the islands that would tackle bottlenecks related to the organizational and financial complexity of waste transfer from islands to the mainland. 	MEPE, EPEEF, Government, RGUs, LGUs and private sector
Next 24 months	<ul style="list-style-type: none"> • Prepare pilot regional master plans and business plans around WMC focusing on separate collection. • Identify investments and prepare technical documentation for investments. • Secure EU funds and co-financing funds for the implementation of regional waste management schemes. 	MEPE, EPEEF, Government, RGUs, LGUs and private sector

Roadmap for enhancing management of nature protected areas and Natura 2000 network

Starting from	Sub-actions	Responsible organizations
T ₀ throughout 2025	<ul style="list-style-type: none"> • Continue with the implementation of activities stipulated in the Nature Protection Strategy and Action Plan. 	MEPE, Authorities managing nature

Starting from	Sub-actions	Responsible organizations
		protected/ Natura 2000 areas
T ₀ + 48 months	<ul style="list-style-type: none"> • Undertake the administrative steps required to initiate public procurement procedures on the preparation of management plans complying with Natura 2000 requirements and a visitors' plan for each nature protected area. • Publish public tenders. • Complete the tenders and make contracts with the organizations that won them. • Prepare draft management and visitors' plans. • Discuss draft management and visitors' plans and present them to stakeholders. • Deliver final management and visitors' plans and approve/adopt them. 	MEPE, Authorities managing nature protected/ Natura 2000 areas
T ₀ + 48 months	<ul style="list-style-type: none"> • Make an inventory about the required number and profile of experts to be additionally employed in nature protection sector. • Undertake necessary administrative steps to initiate hiring. • Publish public tenders for jobs. • Complete the tenders and make contracts with the candidates chosen. Consider including them in the capacity building programme outlined below. • Undertake a capacity building needs assessment to map the needs for strengthening capacities of the staff, guide and other people working in protected areas of nature, as well as of other stakeholders. • Design a capacity building programme accordingly. • Implement the designed capacity building programme (if to be provided by external experts, initiate timely a public procurement or other administrative procedures required). • Evaluate the implementation of the capacity building program. 	MEPE, Authorities managing nature protected/ Natura 2000 areas
T ₀ + 72 months	<ul style="list-style-type: none"> • Set-up an inter-ministerial Task Force for monitoring if environmental objectives and measures are fully integrated into relevant sectoral policies. • Define 1-2 pilot projects testing feasibility of nature-based solutions in relevant sectors. • Secure financing and implement pilot projects on nature-based solutions. • Make an evaluation of the (i) integration of environmental policies into sectoral policies, and of (ii) environmental, economic and social feasibility of nature-based solutions tested. 	MEPE

Starting from	Sub-actions	Responsible organizations
T ₀ + 12 months	<ul style="list-style-type: none"> • Make a deal with relevant authorities and secure a fixed amount of Emission Trading Scheme units to enable financing the management of Natura 2000 network. • Publish the agreement in the Official Gazette or make it official in another manner. • Secure additional financing for managing Natura 2000 network (if needed). 	MEPE

Roadmap for enhancing a multi-sectoral approach to integrated protection and management of the marine environment and coastal zone

Start-ing from	Sub-actions	Responsible or-ganizations
T ₀ + 12 months	<ul style="list-style-type: none"> • Set-up appropriate institutional settings for monitoring if integrated protection and management of the marine environment and coastal zone objectives and measures are fully integrated into relevant sectoral policies. • Develop a set of indicators for monitoring and evaluation of the implementation of the requirements laid down in the Programme of Measures for the Protection and Management of the Marine Environment and Coastal Zone. • Strengthen cooperation within and among sectors that should implement integrated protection and management of the marine environment and coastal zone and ensure that this is fully integrated into relevant sectoral policies. 	MEPE, Ministry of Construction and Physical Planning (MoCPP), Ministry of Agriculture (MoA)
Next 12 months	<ul style="list-style-type: none"> • Evaluate how successful the implementation of integrated protection and management of the marine environment and coastal zone is. Include also a cost-benefit analysis, preferably taking into account positive and negative externalities. If external expertise is required to implement this evaluation, make sure to initiate timely a public procurement or other administrative procedures required. 	MEPE, MoCPP, MoA
Next 36 months	<ul style="list-style-type: none"> • Set-up and implement a capacity building program with relevant stakeholders, including experts and general public. 	MEPE, MoCPP, MoA

6.2 Promote a resource-efficient and low carbon economy

Roadmap for achieving fulfilment of Urban Wastewater Treatment Directive requirements and implementation of water utility reorganization and efficiency improvement process

Starting from	Sub-actions	Responsible organizations
T ₀ + 2 months	<ul style="list-style-type: none"> • Stocktaking and recommended remedial actions • Assess M&E 	MEPE
T ₀ + 6 months	<ul style="list-style-type: none"> • Define investment prioritization • Prepare a timetable and an Action Plan 	Croatian Waters
T ₀ + 12 months	<ul style="list-style-type: none"> • Prepare a financing strategy 	LGUs and water utilities

Roadmap for providing an impetus for transition to a circular economy

Starting from	Sub-actions	Responsible organizations
T ₀ + 12 months	<ul style="list-style-type: none"> • Set up an inter-ministerial Executive Secretariat for the Circular Economy with funding and authority for to facilitate regulatory and other policy interventions. Include private sector and academia. • Initiate preparation of an Action Plan for Circular Economy. Secure financing for its preparation. • Initiate good circular economy practices already proven in EU like: banning of on time use plastics, incentivize piloting of cities and islands without plastics, start with the construction and demolition waste country wide circular economy project 	Government, MEPE, MoCPP, Ministry of Finance (MoF)
Next 12 months	<ul style="list-style-type: none"> • Prepare a draft Action Plan for Circular Economy (include strategies for private sector involvement). • Discuss draft Action Plan and present it to stakeholders and adopt final Action Plan for Circular Economy. • Monitor and evaluate action plan implementation. 	Companies that won the tender, MEPE, MoCPP, MoF
Next 72 months	<ul style="list-style-type: none"> • Secure financing for the implementation of Action Plan for Circular Economy. • Set-up appropriate institutional arrangements. • Implement Action Plan. • Based on regional schemes first experiences, identify technical conditions for recycling; and prepare recyclable market strategy including the private sector. Look at the regional opportunities outside of Croatia. Revise the waste prevention program accordingly. • Monitor and evaluate Action Plan implementation. 	MEPE, EPEEF, MoCPP, MoF

Roadmap for providing impetus for a green spatial planning and creation of green cities

Starting from	Sub-actions	Responsible organizations
T ₀ + 12 months	<ul style="list-style-type: none"> • Appoint a Green Cities Task Force. • Initiate preparation of Sustainable Cities Framework and indicator system. 	MoCPP, MEPE, MoF
T ₀ + 60 months	<ul style="list-style-type: none"> • Implement a robust capacity building program urban and spatial planners and designers. 	MoCPP
T ₀ + 36 months	<ul style="list-style-type: none"> • Revise building codes, especially for existing buildings. • Establish a vacant and derelict land and building survey, value under-used/abandoned properties. • Prepare Strategic Brownfield Redevelopment Planning. • Prepare a programme for managing declining and aging populations in cities. • Prepare Sustainable Redevelopment Strategies for Specific Priority Sites. • Prepare new flood maps. • Modernize hydro-met and early warning services. 	MoCPP, MEPE, MoF
Next 12 months	<ul style="list-style-type: none"> • Monitor and evaluate socio-economic and environmental impacts of pilot projects. 	MoCPP, MoF

Roadmap for building a modern and thriving water sector that supports Croatia’s economic growth and inclusive development and protects its environmental assets for all

Starting from	Sub-actions	Responsible organizations
T ₀ + 2 months	<ul style="list-style-type: none"> • Finalization of legal framework for aggregation of water services 	MEPE, Croatian Waters, LGUs, RGUs, water utilities
Next 6-24 months	<ul style="list-style-type: none"> • Restructuring and legal alignment of water services provision sector with new reform 	LGUs, RGUs, water utilities

6.3 Safeguard against environmental and climate change risks

Roadmap for reducing air pollution and greenhouse gas emissions and making Croatia more climate resilient

Start- ing from	Sub-actions	Responsible or- ganizations
T ₀ + 12 months	<ul style="list-style-type: none"> • Develop a program to support purchasing furnaces with improved combustion and/or replacement of solid fuels with more environmentally friendly fuels or cleaner fuels. (Note: beneficiaries in rural areas could get it funded through the Rural Development Fund). • Prepare administrative steps necessary to run purchase subsidies. • Make a PR campaign promoting adoption of new furnaces and/or replacement of solid fuels. • Open a public announcement (or more of them) for subsidies. • Administer requests for subsidies and make payments to beneficiaries. 	MEPE, EPEEF, MoF, MoA
T ₀ + 60 months	<ul style="list-style-type: none"> • Continue co-financing the purchase of electric, plug-in hybrid and hybrid vehicles and eco-driving training. • Strengthen the control over, and penalize open burning of municipal waste and/or agricultural waste in rural and suburban areas. 	MEPE, EPEEF, MoA
T ₀ + 60 months	<ul style="list-style-type: none"> • Make a plan on how to reduce ammonia emission from agriculture (hire external consultants in needed). • Design and introduce agri-environment measures and accompanying payments (within Rural Development Programme) for reducing ammonia emission from agriculture. • Implement measures from the ammonia reduction plan. • Monitor and evaluate implementation of the ammonia reduction plan. 	MoA, MEPE
T ₀ + 24 months	<ul style="list-style-type: none"> • Design a support system (consultancy services) for strengthening LGUs so that they can successfully implement air emission reduction measures. • Secure financing for the implementation. • Monitor and evaluate implementation of the support. 	MEPE, MoF
T ₀ + 48 months	<ul style="list-style-type: none"> • Undertake administrative steps required to initiate a public procurement procedure for the preparation of an inventory of the quantity of air pollution received by transboundary emissions and an assessment of the related damage. Secure financing for the preparation of this inventory. • Publish a public tender. • Complete the tender and make a contract with the organization that won it. • Prepare a draft report on transboundary emission of air pollutants and related damages. • Discuss draft report and present it to stakeholders. 	MEPE, EPEEF, MoFEA

Start- ing from	Sub-actions	Responsible or- ganizations
	<ul style="list-style-type: none"> • Deliver final report on transboundary emission of air pollutants and related damages. • Initiate an international Task Force aiming at reducing trans-boundary air pollution from the Western Balkans power plants. • Propose in the European Parliament and by the European Commission a set of concrete regulatory, economic and informative policy instruments leading to a reduced air pollution from the Western Balkans power plants. 	
T ₀ + 60 months	<ul style="list-style-type: none"> • Implement an awareness raising program on adaptation to climate change. • Strengthen human and technical capacities for climate modelling. • Develop impact indicators on the implementation of the adaptation strategy for vulnerable sectors and society. • Establish a climate monitoring and early warning system for nature. • Establish a system for calculating health-economic indicators for climate change-related conditions. • Expand the Croatian Platform for Disaster Risk Reduction to climate change-related early warning system. • Strengthen the capacity for the implementation of non-structural measures for protection from flood and drought. • Enhance and modernize civil protection and fire response service. • Strengthen the capacities to assess dangers and responses during disasters and climate-change related accidents. • Strengthen the capacities for coping with sea level rise. 	MEPE, Croatian Waters, Ministry of the Interior (MoI), Ministry of Defense (MoD)

Roadmap for ensuring provision of reliable and safe water supply for the entire population and economy and development of irrigation schemes for inclusive growth; for ensuring protection of people and assets against floods and other adverse effects of water

Starting from	Sub-actions	Responsible or- ganizations
T ₀ + 2 months	<ul style="list-style-type: none"> • Stocktaking and recommended remedial actions for ensuring provision of reliable and safe water supply. • Assess M&E. 	MEPE
T ₀ + 6 months	<ul style="list-style-type: none"> • Define investment prioritization for ensuring provision of reliable and safe water supply. • Prepare a timetable and an action plan. 	Croatian Waters

Starting from	Sub-actions	Responsible organizations
T ₀ + 12 months	<ul style="list-style-type: none"> • Prepare a financing strategy for ensuring provision of reliable and safe water supply. 	LGUs and water utilities
T ₀ + 5 months	<ul style="list-style-type: none"> • Stocktaking of current situation and recommended remedial actions for current bottlenecks in implementation of National Plan Action Plan for Irrigation. 	MoA, Croatian Waters, RGUs,
T ₀ +12 months	<ul style="list-style-type: none"> • Define irrigation-related investment prioritization. • Prepare an Action Plan for irrigation, with timetable and financing strategy. 	Croatian Waters, MoA
T ₀ + 4 months	<ul style="list-style-type: none"> • Preparation and implementation of 2021 River Basin Management Plans (RBMP) and Flood Risk Management Plans (FRMP). 	Croatian Waters
T ₀ + 6 months	<ul style="list-style-type: none"> • Preparation and revision of existing multi-annual programs for construction of regulation and protection water and amelioration facilities. • Prepare a timetable and an Action Plan for protection against floods and other adverse effects of water. 	Croatian Waters
T ₀ + 12 months	<ul style="list-style-type: none"> • Prepare a financing strategy for implementation of the Action Plan protection against floods and other adverse effects of water 	MEPE, Croatian Waters

7 Flagship projects and programs

This chapter proposes a set of strategic projects and programs addressing three broad challenges facing Croatia and aligned with EU environmental priorities: a) Protect, conserve and enhance natural capital; b) Promote a resource-efficient and low carbon economy; c) Manage environmental, natural and climate change risks.

7.1 Improving waste management and moving towards a circular economy

a) **Description of flagship project.**

The project aims to lay the foundations for a circular economy in Croatia by implementing a regional demonstration pilot. Given the low capacity of LGUs and the scale typically required by network services such as waste management, the project will support the development of a Regional Waste Management System based on comprehensive masterplans and waste management centers (WMCs). Regional systems can help to shift the focus from residual waste towards segregated collection and recycling while creating the economies of scale necessary to ensure the financial viability of the services provided.

The pilot project will support the development of business plans for WMC operations, including their financial models. The plans will focus on the potential to extend the collection and processing of recyclables and inform technology selection for the WMCs, particularly for the segregated collection of waste, including bio-waste which requires composting, the sorting of recyclables, and the processing of mixed waste to enable energy recovery (residue derived fuel (RDF); production or waste-to-energy solutions).

The project will also help design and support the implementation of economic and regulatory instruments to incentivize segregated waste collection, such as landfill taxes or landfill bans. Such economic instruments can influence consumer behavior to minimize waste generation, and help practices of service providers to move away from landfilling and strengthen separate collection and recycling. Financial or legislative mechanisms to improve cooperation between regional and local government units in charge of waste management would also be piloted.

b) Project's relevance to national strategic framework. The project is aligned with Croatia's EU commitment to move to a circular economy within the context of waste management and with the EU Accession Treaty. In addition, the project contributes to the following goals outlined in the national strategic framework: (i) Green Croatia; (ii) Competitive, Entrepreneurial, and Innovative Croatia; and (iii) Regional Croatia.

c) Economic potential and exploitation. The segregation of waste and creation of markets for recyclables are basic steps toward the achievement of a resource efficiency and a circular economy. Moving towards such an economy could deliver a range of benefits including reducing the pressure on the environment, making the supply of raw materials more secure, increasing competitiveness, stimulating innovation, boosting economic growth, and creating jobs. At the EU level,

it is estimated that moving from a linear to a circular economy could bring net savings of €600 billion, which is 8% of annual turnover for businesses. It would also reduce EU-wide greenhouse gas emissions by up to four per cent every year. For example, in 2016, economic sectors relevant to the circular economy employed more than four million workers, a 6% increase compared to 2012. The roll out of the pilot has the potential to create jobs in both waste separation and recycling, support establishment of new green SMEs, reduce dependence on imports of raw materials, and avoid environmental damage caused by resource extraction and pollution from non-compliant landfills. It would also help Croatia avoid possible infringement penalties related to bringing waste management practices into compliance with the acquis.

- d) **Sustainability.** Project funding would be assured through the current and next Competitiveness and Cohesion Operating Programme, with up to 20% co-financing from LGUs or RGUs. The project would help the waste management system shift from a focus on capital investments to financial sustainability, and indirectly increase the impact of EU funds. Lessons from the pilots would also help inform the national legislation related to circular economy and waste management.
- e) **Duration.** Three years (expected to be completed by the end of 2023).
- f) **Estimated amount of funding required.** Funding for regional schemes would be available from the current and next Competitiveness and Cohesion Operating Programme. Investments of approximately HRK 2.5 billion (EUR 340 mil) will be required for the construction of the WMCs (Zagreb WMC excluded), and another HRK 100 million (EUR 1.35 million or 3-5% of the total) for design work and tendering process will be needed. Advisory services, that are part of project preparation activities, including master plans and business plans, are estimated to cost 1.5-2% of total system investments (HRK 5.1 billion (EUR 692 million), including LGU level investments), and will equal HRK 100 million (EUR 13.5 million).
- g) **Preconditions - points for consideration before the project can begin.** The preconditions are: a) positive economic incentives that could stimulate cooperation among LGUs; and b) a multi-stakeholder team that would lead the pilot and would be comprised of representatives of MEPE, EPEEF, LGU and RGU representatives, or representative of association of LGUS, NGOs, chamber of commerce and technical experts. Passing bylaws related to landfill taxes will be critical to the success of the project.
- h) **Project leader.** Responsible organization: Ministry of Environmental Protection and Energy; Ministry of Regional Development and EU funds, and Environmental Protection and Energy Efficiency Fund.
- i) **Beneficiaries.** Population in the impacted municipalities and local businesses will be the direct beneficiaries

7.2 Improving the quality and coverage of water service provision and protecting the aquatic environment

- a) **Description of flagship project:** The project aims to improve the quality of water and wastewater services to be in line with EU requirements, achieve UWWTD and DWD compliance, based on

the continuation of ongoing implementation efforts for fulfilment of directive requirements. Individual project stages/activities would include:

- (i) Review of the implementation process and recommended remedial actions: The activity would conduct a functional review of the water sector, carrying out a stocktaking assessment of the current implementation progress and identifying bottlenecks, particularly with regard to low EU fund absorption. Address aims to assess pressing institutional challenges facing the absorption of EU funds and bottlenecks in the implementation of the EU water directives. The functional review would assess institutional roles and responsibilities; capacity, mandates and sector-strategies in order to propose remedial measures; and perform a root cause assessment on the reasons for delays in the construction sector.
 - (ii) Assesment of M&E: Assessment of the monitoring, evaluation and reporting on UWWTD and DWD implementation. The assessment of the M&E framework should be carried out with respect to data collection, sharing and analysis (including, inter alia, the identification of the responsibilities of actors, frequency and timelines for data input and analysis, and the structure for information flow and sharing).
 - (iii) Investments prioritization: An updated assesment of investment needs though the updating and regeneration of water supply and sanitation (WSS) master plans and other planning documents, including optimization of compliance costs (such as the review and update of the definition of agglomeration boundaries, IAS, etc., the spatial coverage of which should be adjusted for changes in spatial conditions, such as changes in the number of users, economic trends, and financial capacities of the population), followed by prioritisation of investments based on criteria of contribution toward directive compliance and cost efficiency.
 - (iv) Preparation of financing strategy: Preparation of a strategy for the financing of UWWTD and DWD compliance achievement, including cost recovery, sources of funding, and affordability. This activity would cover outstanding investments to address the challenges of UWWTD and DWD requirements as outlined in point (i) and (iii) above, and propose solutions to secure the required funding and bridge the expected funding gap in the project implementation.
 - (v) Key investments required for compliance, and implementation of measures required for achievement of EU UWWTD and DWD. The investments would be identified based on efficiency and effectiveness criteria.
- b) Project’s relevance to national strategic framework.** Project is aligned with Croatia’s Water Sector Strategy, and Croatia’s EU commitments toward achieving harmonization with key EU directives in the time frame agreed to during Croatia’s membership negotiation process, and Accession Treaty.
- c) Economic potential and exploitation:** The UWWTD and DWD are important environmental and service provision legislations that levels the field for environmental and public health protection—and overall access to the European single market – and, therefore, does not necessarily need to yield a positive economic cost-benefit ratio by itself.
- d) Sustainability:** Financing gaps between tariff revenues and total costs of wastewater services are expected to widen further, as progress is made towards full UWWTD compliance, creating serious challenges in the medium to long term. Should EU grants for UWWTD investment cease around 2023, the financing gap for remaining investments and reinvestments will be bridgeable only with commercial loans. This will require governments to facilitate the establishment of financially viable water utilities.

- e) **Duration:** All activities should be completed by January 1, 2024.
- f) **Estimated amount of funding required:** €2.9 billion investments will be needed to achieve compliance with the Urban Wastewater Treatment Directive by 2023, and an estimated €0.85 billion investments to achieve full Drinking Water directive compliance by 2023. With €1.1 billion of EU funds already allocated in the exiting EU programming period, and investments for them overcommitted, it can be estimated that €2.5 billion of investment will still be needed for directive compliance.
- g) **Preconditions - points for consideration before the project can begin:** a number of measures are required to improve the likelihood of achieving the desired results, including: (i) Implementing a water utility sector reform, (ii) Fostering the adoption of cost-effective innovations in the wastewater sector, and (iii) Strengthening utilities' financial viability to ensure operational sustainability and access to financial markets.
- h) **Project leader:** Responsible organization: Ministry of Environmental Protection and Energy and Croatian Waters. Implementing organization: Croatian Waters, local and regional governments and water utilities.
- i) **Beneficiaries:** Local and regional government units. While the population in impacted municipalities will have a direct benefit from project implementation, the total population of Croatia will benefit from an improved environmental situation resulting from achievement of WFD.

7.3 Enhancing Resilience

(i) Climate Adaptation of coastal areas

- a) **Description of flagship project:** Croatia's coast is the backbone of Croatia's tourist industry, generating nearly 20% of the country's GDP (more than in any other EU MS). The country's marine and coastal resources are also essential for fishers, fish farming and processing. However, Croatia's marine and coastal resources are highly vulnerable to climate change. Increases in sea-water and air temperatures, increases in salinity in the Adriatic Sea, the rise of sea-levels and other climate change-induced hazards are projected to threaten the livelihood of those living along the coast and negatively impact Croatia's tourism and fishery sectors.

The project includes activities aiming at strengthening Croatia's capacity for adaptation to climate change, as well as concrete measures enabling coastal areas to adapt to climate change. The project activities comprise the following:

- (i) Strengthening capacities for monitoring, research and (vulnerability) assessment of climate change impacts and their effects on marine and coastal resources, as well as strengthening capacities for climate-adaptation spatial planning;
- (ii) Design and implementation of vulnerability and adaptation plans, including new spatial plans that take into account the impact of extreme weather and the rising sea levels;
- (iii) Adaptation of coastal structures (waterfronts, breakwaters and marinas) and coastal urban infrastructure (roads, pipelines, cables, etc.) to rising sea levels and increased extreme weather;

- (iv) Implementation of measures to prevent wildfires (e.g. setting-up surveillance systems, construction and maintenance of access roads and fire break corridors, provision of sufficient water for fire extinguishing, etc.);
 - (v) Prevention of salinization of freshwater and coastal habitats caused by the rise of sea levels, preferably by implementing various nature-based solutions (e.g. development of “Green Infrastructure” – landscaping of watercourse sections with natural flow characteristics, eco-remediation principles, etc.);
 - (vi) Prevention and emergency measures in case of sea floods caused by rising sea levels;
 - (vii) Prevention of urban heat islands caused by high air temperatures in the summer months;
 - (viii) Strengthening the resilience of coastal water utility infrastructure and coastal water resources by (i) reconstructing and rehabilitating water-communal infrastructure and water resource interventions, (ii) dislocating water interventions outside the influence of the sea, (iii) artificially replenishing coastal aquifers with purified wastewaters and (iv) constructing controlled mobile enclosures at watercourses.
- b) Project’s relevance to national strategic framework:** The proposed flagship project would contribute primarily to the following development directions included in the national strategic framework: (i) *Competitive, Entrepreneurial, and Innovative Croatia*; (ii) *Recognizable Croatia*; and (iii) *Green Croatia*.
- c) Economic potential and exploitation:** The exact economic benefit of the project is difficult to estimate. Economic losses from climate change on the economic sectors in the coastal zone, its marine and other ecosystems, human health and well-being are likely to be large, and to increase exponentially over time in the absence of any actions. The loss in the tourism sector alone would likely reach several billion EUR per year. Climate change would hit fisheries, coastal zone agriculture, services and other economic sectors. In addition, climate change is likely to cause a loss of coastal land due to the rise in sea levels, damage/destroy properties and infrastructure (roads, public water supply system, etc.), increase public and private health bills, etc. Much of this economic loss could be prevented or reduced by implementing proper adaptation measures.
- d) Sustainability:** The proposed project is largely based on the measures and recommendations presented in the key Croatian documents dealing with climate change and coastal zone management: (i) Draft Strategy on Adaptation to Climate Change in the Republic of Croatia for the period until 2040 with a view to 2070, (ii) The Programme of Measures for the Protection and Management of the Marine Environment and Coastal Zone of the Republic of Croatia, and (iii) the Integrated Coastal Zone Management (ICZM) Plan of the Šibenik-Knin County⁸. Funding for its implementation can be provided by the sources indicated in those documents, including EU Structural Funds and the Cohesion Fund, the European Maritime and Fisheries Fund (EMFF), national public funds and the bank loans.
- e) Duration:** 7 years (2021-2027)
- f) Estimated amount of funding required:** Approximately 1-3 billion EUR.

⁸ In May 2019, at the fourth European Conference on Climate Change Adaptation held in Portugal, in the competition with 28 projects from 9 Mediterranean countries, the Integrated Coastal Zone Management (ICZM) Plan of the Šibenik-Knin County was awarded the “Mediterranean Climate Change Adaptation Award” as an exemplary action of a coastal zone adaptation to climate change. The Plan was prepared within a framework of a Global Environment Facility (GEF) project in accordance with the Integrated Coastal Zone Management (ICZM) Protocol for the Mediterranean.

- g) Preconditions - points for consideration before the project can begin:** Essential preconditions are: (i) MEPE should prepare a detailed project proposal, specifying project objectives, activities, eligibility criteria, etc., (ii) financing should be secured, (iii) a public tender should be initiated and published, and (iv) best bid(s) selected and contracted. The project implementation is not linked to a specific policy reform, or a change of regulatory framework.
- h) Project leader:** Ministry of Environmental Protection and Energy and/or local and regional government units.
- i) Beneficiaries:** local and regional government units, population living in coastal zone, tourist industry, fishermen and fish farming/processing companies.
- (ii) National Resilience and Enhanced Emergency Response Program**
- a) Description of flagship project:** Croatia is highly prone to disasters, with floods in 2010, 2012 and 2014 resulting in more than €800M in direct damage⁹, storms, extreme heat events often associated with devastating wildfires such as fires in 2017, landslides, and rarer but damaging earthquakes (1667 Dubrovnik and 1830, 1838 and 1880 Zagreb earthquakes). As the climate warms, extreme weather events may become more frequent and intense. As a member of the EU Civil Protection, Croatia needs to ensure that it has a modern disaster response system that meets the changing needs. Moreover, under the new EU rescue system, Croatia also needs to be ready to support other EU members to respond to major disasters and to accelerate development and implementation of national prevention and preparedness strategies. The key project activities comprise the following:
- (i) Establishment and operationalization of the national Operation and Coordination Center;
 - (ii) Establishment of national and regional civil protection training centers;
 - (iii) Ensuring civil protection and fire response buildings are aligned with modern responses and functional requirements; are resilient to storms, earthquakes and floods; are energy efficient and are adequately equipped for urban search and rescue, flood and water rescues, wild and urban fire responses, and technological threat management;
 - (iv) Establishment of national resilience grant program to support local level disaster risk management capacity, including capacity development for local civil protection plans, investment planning, strengthening resilience of critical buildings and infrastructure assets, development of resilient cultural heritage and tourism services;
 - (v) Enhancing of hydro-meteorological monitoring, analysis and early warning systems. This should include last mile connectivity to citizens and decision makers – for example to ensure early action such as evacuation or shelter in place in case of extreme weather and wildfire – to short- and medium-term forecasts for water management, agriculture and so forth;
 - (vi) Development of the evidence basis for action, from cost-benefit analysis, historical damage and loss data systems, national and sub-national risk assessments, investment planning and prioritization – which will also support achievement of forthcoming EU enabling conditions on DRM Plans;
 - (vii) Updating and strengthening of building and infrastructure codes to embed resilience into new and existing construction of buildings and critical infrastructure across Croatia;
 - (viii) Citizens’ awareness campaigns (including for tourists) on how to prepare for, and respond to, natural disasters;

⁹ EU Solidarity Fund

- (ix) Development of options to increase financial resilience to natural disasters at household, asset, city and sovereign levels, including risk transfer, social safety nets, contingent credit, budget lines and so forth.
- b) Project's relevance to national strategic framework:** The proposed flagship project would contribute primarily to the following development directions included in the national strategic framework: (i) *Green Croatia*; and (ii) *Economically Stable and Efficient Croatia*.
- c) Economic potential and exploitation:** The economic benefit of this program is difficult to estimate, given the range of activities. However, analysis from the USA indicates that the benefit to cost ratios for resilience activities range from 6:1 to 12:1 for ensuring buildings meet code requirements for floods, storms and earthquakes and 6:1 benefit to costs for investment of federal funds into resilience grants at local levels. For development of hydro-meteorological and early warning systems benefit to cost ratios range between 1:4 and 1:36 globally. These are measurements of the direct damage avoided, and when considerations are made of broader economic factors such as impacts on tourism, employment, impacts on socially and financial marginal people, loss of culture heritage and so forth, investment in resilience makes even more financial sense.
- d) Sustainability:** Funding for the implementation of this project can be provided by the EU Structural Funds and the Cohesion Fund and national public funds.
- e) Duration:** 7 years (2021-2027)
- f) Estimated amount of funding required:** Approximately 200-300 million EUR.
- g) Preconditions - points for consideration before the project can begin:** To access EU funds, the enabling condition on the development of a national disaster risk management plan should be met (Article 6 (a) of Decision No 1313/2013/EU). The project preparation should also include an inventory of all government and local government assets required to respond and conduct assessments on the resilience and criticality of these buildings so as to ensure the objective prioritization of buildings for intervention. The ownership of any building to be intervened under the Project should also be clear. Prior to the development of national awareness programs, it would be ideal to conduct a baseline survey to understand how different demographic group access information on preparedness and early warning. Other essential preconditions are: (i) MCPP should prepare a detailed project proposal, specifying project objectives, activities, eligibility criteria, etc., (ii) financing should be secured, (iii) a public tender should be initiated and published, and (iv) best bids selected and contracted. The project implementation is not linked to a specific policy reform, or a change of regulatory framework.
- h) Project leader:** National Protection and Rescue Directorate (NPRD) / Ministry of Interior, including partnerships with other authorities responsible for implementing of key components such as State Hydro-meteorological Service and Ministry of Construction and Spatial Planning.
- i) Beneficiaries:** National and local emergency responders, communities and citizens.
- (iii) Establishment of national advisory and education center on climate change adaptation environment and nature protection.**
- a) Description of flagship project:** Environmental issues are inherently cross-cutting and environmental impacts are often the result of economic activity in different sectors. Although legislation and mandates exist, environmental policies and measures are not well integrated into sectoral policies. Given that sectors impact the environment, and that the environment impacts sectors, the successful implementation of any environmental policy largely depends on its integration and implementation in sectoral policies. The EIA and SEA mechanisms have been successful to a certain extent, but more efforts are needed. Climate change and biodiversity are highly interdependent, and are also both key factors to take into consideration when planning for disaster risk

reduction, poverty eradication, and preserving livelihoods. Most investments in one policy will contribute to achieving the goals set by another policy. However, there could also be trade-offs between the two agendas. For instance, the promotion of renewable energy could lead to loss of biodiversity in some other areas, for example, when biodiverse forests were transformed into plantations, when biodiverse grasslands or peatlands and wetlands were transformed into energy crops, or when new hydropower dams reduced the biodiversity of river basins.

The idea behind a national advisory and education center on climate change adaptation, environment, and nature protection would be to ensure that: a) environmental policies are well integrated in other sectors, b) environmentally, climate change and nature friendly projects are valued and recognized and c) there is a general education of the public and different stakeholders on the benefits (environmental social and economic) of integrating climate change and nature protection in projects and planning that would lead to change of mindset from “do not harm” to “do better”.

The center would support the most obvious win-win area is the development of Natural Climate Solution actions, such as the restoration of the ecosystem and ecosystem-based approaches to climate change adaptation and mitigation, and disaster risk reduction¹⁰. It should support the promotion of nature/ecosystems solutions which should not be seen as obstacles to growth, but rather as a basis for sustainable growth.

The project would more specifically ensure:

- (i) Establishment of a multidisciplinary center, including providing adequate space, human resources and equipment.
 - (ii) Climate and nature proofing projects, especially for EU funding, where advice would be provided to business as usual practices in the early design phase, advocating - where proven possible (where technically and financially feasible)- sustainable ecosystem management (SEM) and climate change resilience solutions.
 - (iii) Linking sector financing of strategies and programs with climate and nature protection proofing.
 - (iv) Develop and institutionalize a mechanism for ensuring that climate and nature risks are addressed in planning and project preparation.
 - (v) Continuous education of stakeholders and public on the importance of climate change and nature protection integration into planning and project for sustainability and development. Citizens’ awareness campaigns.
- b) Project’s relevance to national strategic framework:** Project is aligned with Croatia’s EU commitment to adapt to climate change. It also builds on advices that are prepared for the EU strategy on biodiversity to 2030 (in the making). In addition, the project contributes to the following goals outlined in the national strategic framework: (i) Green Croatia; and (ii) Recognizable Croatia.
- c) Economic potential and exploitation.** Biodiversity is key to food security and a direct contribution to sustainable development, which is of great importance for ensuring a good quality of life. Over the last 100 years, globally, more than 90 percent of crops have disappeared from our fields, while many domestic animals have been lost. This loss of diversity, including genetic diversity,

¹⁰ They provide water filtration and moisture retention, flood buffering, soil health, biodiversity habitat, carbon sequestration and enhanced climate resilience.

poses a serious risk to global food security, reducing the resistance of agricultural systems to pests, pathogens and climate change. On the other hand, economic losses (resulting from climate change) on the economic sectors, ecosystems, human health and well-being are likely to be paramount. The loss in the tourism sector alone would likely reach several billion EUR per year. But this is only a portion of the total economic loss. Climate change would hit fisheries, agriculture, services and other economic sectors. Much of this economic loss could be prevented or reduced by implementing proper adaptation measures.

- d) **Sustainability.** The center's establishment can be supported by EU funds and in time through service providing,
- e) **Duration:** The establishment of the center is expected to continue until 2021, and the center should become full and self-sufficiently functioning by 2025.
- f) **Estimated amount of funding required:** Investments of approximately EUR 20 mil will be required for the construction/adaptation of the premises of the center, human capacities and procurement of equipment.
- g) **Preconditions - points for consideration before the project can begin:** The preconditions are: a) positive economic incentives (e.g. national financing of EU projects) that could stimulate SEM vs. BAU approach with the investors; and b) a multi-stakeholder team comprised of representatives of MoEE and other implementing organizations to coordinate the establishment of the center.
- h) **Project leader: Responsible organization:** Ministry of Environment and Energy. **Implementing organizations:** Ministry of Environment and Energy, Environmental Protection and Energy Efficiency; Ministry of Science and Education, Ministry of Economy, Entrepreneurship and Crafts, Ministry of Regional Development and EU funds, Ministry of Agriculture,
- i) **Beneficiaries:** National government, local and regional government units, private sector. The total population of Croatia will benefit from the foundation of this center.

7.4 Sustainable Cities

- (i) **Sustainable urban planning and financing**
 - a) **Description of flagship project:** The project would aim to improve urban and spatial planning approaches and the capacities of municipalities for integrated planning. This activity would also include revising building codes, especially for existing buildings (which will need to be in place by 2020 considering EU plans in this direction). Linked to improvements in spatial and urban planning, the project would introduce advances in municipal asset management, municipal finance self-assessments, and capital investment planning at the municipal level. At the national level, the project would establish a Sustainable Cities Framework and indicator system including national standards, guidelines and indicators for green urban infrastructure and circular economy approaches. Capacity for local planning and place-making will be key to raising local economic development and the project would support pilot investments to design safe and resilient public spaces and green spaces and identify sustainability mobility interventions such as bikes lanes, walking paths and seamless ticketing for public transport. Creating and restoring green space and infrastructure in urban areas is one of the most important elements to help cities become healthier and better places

to live and work as well as retaining and attracting talent. On the other hand, the project would provide Technical Assistance for managing the declining and aging populations in cities and towns, including through approaches to consolidating or densifying urban form, managing municipal service provision, and elderly care services— in other words, smart decline strategies.

- b) **Project's relevance to national strategic framework.** The proposed project would contribute primarily to the following development directions included in the national strategic framework: (i) *Green Croatia*; (ii) *Economically Stable and Efficient Croatia*; and (v) *Regional Croatia*.
- c) **Economic potential and exploitation.** Municipalities rely heavily on transfers from the national level and this initiative would support them in creating the basis for better planned and managed investments that have the potential to ensure an efficient use of limited resources and create the opportunity for generating own-source revenues in the longer-term.
- d) **Sustainability:** The project would have strong owners by the Ministry and buy-in options from local municipalities who have limited capacity for spatial and urban planning. There is growing interest amongst municipalities in these topics and new potential funding on safe public space.
- e) **Duration: 7 years**
- f) **Estimated amount of funding required:** The project would require significant technical assistance resources with some funding for pilot interventions in public space improvements. Total budget would be circa 50 million Euros and could be complemented with local municipal budgets for public space investments and greening.
- g) **Preconditions - points for consideration before the project can begin:** N/A
- h) **Project leader:** Ministry of Construction and Spatial Planning (in collaboration with municipalities and municipal associations)
- i) **Beneficiaries:** Municipalities, citizens, business owners, communities, children.
- (ii) **Redevelopment and Adaptive Reuse of Brownfield and Vacant Land and Buildings**
 - a) **Description of flagship project:** This project would have four key elements. First, it would establish a vacant and derelict land and building survey, to help prepare a national strategy for capturing value from under-used/abandoned land, building, and industrial complexes. Second, it would provide technical assistance for *Strategic Brownfield Redevelopment Planning* in key cities including a demand study for real estate development that assesses the macroeconomic environment that is impacting the real estate market and use this to guide urban development and prioritize assets for release. Third, it would provide Technical Assistance to create *Sustainable Redevelopment Strategies* for Specific Priority Sites. Redevelopment strategies for these sites would vary in complexity, and would need to consider stakeholders, market viability, infrastructure requirements, development size, etc. The project could also establish potential pilots to demonstrate financing schemes for priority site redevelopment. The project would incorporate environment and sustainability dimensions in the redevelopment process.
 - b) **Project's relevance to national strategic framework:** The proposed project would contribute primarily to the following development directions included in the national strategic framework: i) *Competitive, Entrepreneurial, and Innovative Croatia*; and (ii) *Green Croatia*;

- c) **Economic potential and exploitation:** Croatia has existing land and built assets which are currently not utilized but have potential for redevelopment if well-planned and designed based on a realistic assessment of real estate demand. By better managing assets and the release of assets depending on the real estate market, and by introducing mechanisms to capture more value from redevelopment for local revenues, these interventions have the potential to raise new sources of revenue for subnational entities.
- d) **Sustainability:** The project would put in place tools and increased capacity for better management of national and municipal assets. If well established, the project interventions could provide the basis for ongoing interventions that best use municipal assets and generate recurring revenues for cities and towns.
- e) **Duration: 7 years**
- f) **Estimated amount of funding required:** The project would require circa 20 million Euros of technical support. Pilot projects could be supported through operational programs depending on the type of municipal investment, including environment and regional development.
- g) **Preconditions - points for consideration before the project can begin; N/A**
- h) **Project leader:** Ministry of Construction and Spatial Planning
- i) **Beneficiaries:** Municipalities, communities, business, developers.

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