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Preface

This third *Environmental Performance Review* of Switzerland examines the progress made in achieving the country's environmental objectives since the OECD's previous review, published in 2007. Much has changed since then. Just last May, on 21 May 2017 precisely, the Swiss population voted «yes» on a government proposal to revise the Energy Act to allow a gradual phase-out of nuclear energy while increasing reliance on local renewable energy sources. This is expected to lead to investment and jobs in Switzerland, benefiting not only the environment, but also the population and the economy. The Swiss carbon tax has been increased last year to EUR 77 per tonne and compares very favourably with that in the few OECD countries which introduced such a tax. The Swiss Emissions Trading Scheme will soon be linked to that of the European Union after a long negotiation period.

There have also been significant efforts undertaken by Switzerland to improve the environmental performance of its agricultural sector. In particular, in recent years, a large share of payments under the agricultural policy have been explicitly devoted to the protection of farm biodiversity and the Swiss landscape. Switzerland has also been proactive in the field of transport. It is one of three OECD countries that tax diesel at a higher rate than petrol. A modal shift of freight from road to rail is encouraged through road pricing for heavy goods vehicles and, with the December 2016 opening of the Gotthard Base Tunnel, the world's longest rail tunnel.

On some environmental scores, Switzerland comes out rather well. Most notably, the country is a top OECD performer in terms of greenhouse gas emissions intensity as well as material productivity. Switzerland should also be commended for its innovative approach to strengthening the nexus between water and biodiversity. In particular, since 2011, with the in-depth revision of the Water Protection Act, it has embarked on a long journey towards the 'renaturation' of its rivers. This is a fascinating example of a policy initiative that crosses many boundaries since it deals not only with water and biodiversity policy but also energy policy and land use planning.

Recent polling showed that a large majority of Swiss believe the environment in Switzerland is doing very well. However, there is plenty to suggest that Swiss satisfaction with the environment is disconnected from the reality of the situation. Municipal waste has increased by 27% since 2000, in line with private final consumption. Switzerland has some of the highest percentages of threatened species across OECD countries, including mammals. Half the 20 largest Swiss lakes still suffer from eutrophication and lack of oxygen, some of them to the point of having to be artificially ventilated.

Beyond that, Switzerland has a huge ecological footprint associated with unsustainable consumption patterns. Swiss consumption is imposing significant pressure far beyond its borders. The Green Economy Action Plan, which Switzerland adopted in 2013, recognises the need for a shift towards more sustainable consumption patterns consistent with living within the planet's limits.

This Review presents 42 recommendations to strengthen Switzerland's environmental policies and performance. I hope that it will also make a useful contribution to current efforts to improve policy coherence and promote the environment as a source of economic growth.



Angel Gurría
OECD Secretary-General

Foreword

The principal aim of the OECD Environmental Performance Review programme is to help member and selected partner countries improve their individual and collective performance in environmental management by:

- helping individual governments assess progress in achieving their environmental goals;
- promoting continuous policy dialogue and peer learning;
- stimulating greater accountability from governments towards each other and public opinion.

This report reviews Switzerland's environmental performance since the second review in 2007. Progress in achieving domestic objectives and international commitments provides the basis for assessing the country's environmental performance. Such objectives and commitments may be broad aims, qualitative goals or quantitative targets. A distinction is made between intentions, actions and results. Assessment of environmental performance is also placed within the context of Switzerland's historical environmental record, present state of the environment, physical endowment in natural resources, economic conditions and demographic trends.

The OECD is indebted to the government of Switzerland for its cooperation in providing information, for the organisation of the review mission to Bern (28-30 November 2016) and for facilitating contacts both inside and outside government institutions.

Thanks are also due to the representatives of the Czech Republic (Lukáš Pokorný) and of the European Commission (Rayka Hauser, Directorate-General for Environment) for examining Switzerland's environmental performance.

The authors of this report were Gérard Bonnis, Raphaël Jachnik, Aleksandra Paciorek and Alexa Piccolo (all OECD Secretariat), Félix-A. Boudreault and Rachel Samson (consultants). Nathalie Girouard provided oversight and guidance. Mauro Migotto provided statistical support; Annette Hardcastle provided editorial and administrative support; and Rebecca Brite copy-edited the report. Preparation of this report also benefited from inputs and comments from several members of the OECD Secretariat, including Joëlline Bénéfice, Jane Ellis, Florens Flues, Guillaume Gruère, Katia Karousakis, Xavier Leflaive, Patrice Ollivaud, Ronald Steenblik, Simon Upton, Kurt Van Dender, Václav Vojtech and Frédérique Zegel.

The OECD Working Party on Environmental Performance discussed the draft Environmental Performance Review of Switzerland at its meeting on 27 June 2017 in Paris, and approved the Assessment and Recommendations.

Executive summary

Improved environmental performance but not in all domains

Against the backdrop of economic growth in line with that of the OECD average since 2000, Switzerland has made progress in decoupling by reducing emissions of greenhouse gases (GHG) and other main atmospheric pollutants, curtailing freshwater abstraction and enhancing material productivity. Energy consumption is decreasing and becoming less intensive. There is an increasing modal shift of freight from road to rail. Half of municipal waste is recycled. Well-being perception is generally high.

Nevertheless, a number of environmental pressures remain. Municipal waste generation is rising. Eutrophication affects water quality in many lakes. Use of agricultural nitrogen inputs remains excessive and results in nitrogen deposition beyond critical loads for ecosystems. Mostly dyked Swiss streams struggle to fulfil their natural functions. More than one-third of species are threatened and few habitats of national importance are strictly protected. Still waters, shores and wetland ecosystems are threatened. Land take is gaining pace, especially on the outskirts of cities, fragmenting habitats and diminishing biodiversity. Concentrations of NO₂ and particulates in the air are still above the legal ambient limit values in areas of heavy traffic and there are peaks of summer ozone in some rural areas.

Environmental democracy but implementation gaps on the ground

Switzerland has a long tradition of direct democracy through referendums and popular initiatives, which are useful in giving an impulse to policy making. Switzerland also has a well-developed system of ex ante evaluation of environmental policy, including assessments of cost-effectiveness, regulatory impact and sustainability, while strategic environmental assessment has yet to be introduced. Switzerland ratified the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters in 2014. Since 2015 environmental information has had to be released in open and digital form (if possible), as part of an «open government data» system.

Federal «enforcement aids» promote uniform application of federal law across the cantons. However, there are no federal environmental inspectorates and a 2013 federal survey revealed that insufficient inspection was impeding proper implementation of environmental law. Switzerland needs to mobilise more inspection resources, prioritise risk-based inspection and develop inspection synergies among cantons (via methods such as peer reviews). Environment police exist in most cantons, but prosecutors often lack expertise in environmental law.

Switzerland has strengthened financial rules for environmental damage; in particular, the law now requires the clean-up of contaminated sites.

Promising steps towards greener growth

Switzerland has made progress in greening its economy, as illustrated by its above-average performance on a number of green-growth-related indicators. It has opportunities to do more, including addressing the environmental impact of consumption. Acknowledging the need to further green the economy, the Federal Council (the government) adopted a well-defined Green Economy Action Plan in 2013. A major achievement of climate policy was the introduction, in 2008, of a CO₂ tax, which was raised to EUR 77 per tonne in 2016, one of the highest rates in the OECD. However, a narrow tax base (road fuel is excluded and there are many tax exemptions) combined with a low carbon price under the Swiss emission trading system makes it challenging to meet the intended GHG reduction objectives by 2030.

The planned phase-out of nuclear energy will require scaling and speeding up the deployment of renewable energy sources and energy efficiency solutions. Policy options include expanding the CO₂ tax base and incentive-based taxation more generally. Switzerland is one of the few OECD countries that tax diesel fuel at a higher rate than petrol. The heavy goods vehicle tax was effective in speeding up renewal of the fleet and the modal shift of freight from road to rail. However, mobility pricing has remained at the level of pilot testing. The economy features a sizeable financial industry. Mainstreaming environmental considerations into business and investment decisions, as well as increasing private participation in financing green investments, could yield significant environmental benefits.

Paving the way for new aspects of water management...

Switzerland is one of the first countries implementing a national policy to reduce micro-pollutants in municipal sewage treatment plant effluents, consistent with the polluter-pays principle. Many micro-pollutants have been detected in Swiss surface waters, and they can have adverse effects on aquatic ecosystems (e.g. feminisation of male fish by hormonally active substances) and possibly on human health. Nitrogen and pesticide loads in watercourses remain too high. Switzerland is considering tax incentives to improve agricultural nutrient and pesticide management but it lags behind the European Union in preparing a pesticide action plan. Growing urbanisation threatens groundwater, the source of 80% of Swiss drinking water, so groundwater protection should become an integral part of land use planning.

Switzerland has embarked on an innovative approach to the rehabilitation of its rivers. Around 40% of rivers have been altered, with adverse consequences for nature and landscape. Since 2011, the cantons must provide sufficient space for all surface waters to ensure their

natural functioning; hydropower production must reduce its negative impact on downstream waters by 2030 and some 25% of waters with poor morphological status must be rehabilitated over the longer term. Switzerland is also to be commended for its consensus-building approach to setting «acceptable» minimum flows for hydropower development since 1991, though the approach has rarely been implemented in practice. About 25% of hydropower plants built prior to 1991 do not meet the pre-1991 minimum flow requirements, which were less stringent.

...but lagging behind in biodiversity conservation policy

Switzerland released a national biodiversity strategy in 2012 and finally approved the accompanying action plan in September 2017, three years past the commitment to do so. Protected areas have expanded but remain short of the global Aichi target to protect 17% of the earth's land surface by 2020. Switzerland also has lower levels of strict protection than other OECD countries, relying heavily on a game reserve designation originally intended to limit excessive hunting. The quality of protected areas is also lacking: many are too small, poorly connected with each other and with European networks, and do not fully meet conservation objectives. Access to information on the state of biodiversity and proactive awareness campaigns are necessary to correct what polls show is a misconception by most Swiss that nature is doing well.

Efforts have been made to mainstream biodiversity considerations into sectoral policies, but more could be done. Significant reform to agricultural support has shifted emphasis to biodiversity and landscape protection. Switzerland has dedicated only 5.6% of forest surface as forest biodiversity reserves, among the lowest levels in Europe, though it committed itself to protect 8% by 2020 and 10% by 2030. Expansion of tourism and transport infrastructure increases the risk of landscape fragmentation and habitat disturbance. More wildlife corridors are needed, along with increased reliance on fees for tourism operations. Maintenance of landscape services is ultimately in the tourism industry's interest, so there is a good case for consumers of these services paying for their maintenance.

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Assessment and Recommendations

The Assessment and recommendations present the main findings of the Environmental Performance Review of Switzerland and identify 42 recommendations to help Switzerland make further progress towards its environmental policy objectives and international commitments. The OECD Working Party on Environmental Performance reviewed and approved the Assessment and recommendations at its meeting on 27 June 2017. Actions taken to implement selected recommendations from the 2007 Environmental Performance Review are summarised in the Annex.

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1. Environmental performance: Trends and recent developments

Switzerland has a small open economy, with the fourth highest gross domestic product (GDP) per capita in the OECD. Economic growth quickly recovered after the 2009 recession, faster than that of its main European trading partners, driven mainly by exports and household consumption. Living standards have continued to increase, with annual average growth of 0.6% over 2009-15 (OECD, 2017a). Rising income and consumption have resulted in higher waste generation and stronger pressures on the environment. This is particularly the case on the Swiss Plateau, whose population density is comparable to that of the Netherlands.

Switzerland is poorly endowed with mineral raw materials and energy resources other than water. Perhaps not surprisingly, it is a top OECD performer in terms of energy supply per unit of GDP, greenhouse gas (GHG) emissions per unit of GDP and GDP per unit of domestic material consumption. However, Switzerland remains among OECD countries with a relatively high per capita consumption-based environmental footprint, as was noted in the previous Environmental Performance Review (OECD, 2007). Further, between half and three-quarters of the Swiss environmental impact is estimated to be embodied in the import of goods and services, in particular in relation to food consumption, housing and mobility (Frischknecht et al., 2014). As a result, more sustainable patterns of consumption should be sought to further improve Switzerland's resource efficiency in the context of global value chains.

A mountainous country at the centre of the Alpine arc, Switzerland is known as the water tower of Europe for its significant water resources. It also has a rich variety of natural and cultural landscapes, which contribute to the reputation of Swiss tourism and, consequently, to economic development. The Swiss public perceives environmental quality as generally high (FSO, 2016). However, water quality is threatened by nutrient pollution from agriculture and by micro-pollutants, while economic development has profoundly altered the structure of watercourses. Biodiversity is challenged by land use intensification – for agriculture and construction of settlements, roads and industrial zones – and the landscape is increasingly fragmented by expanding infrastructure.

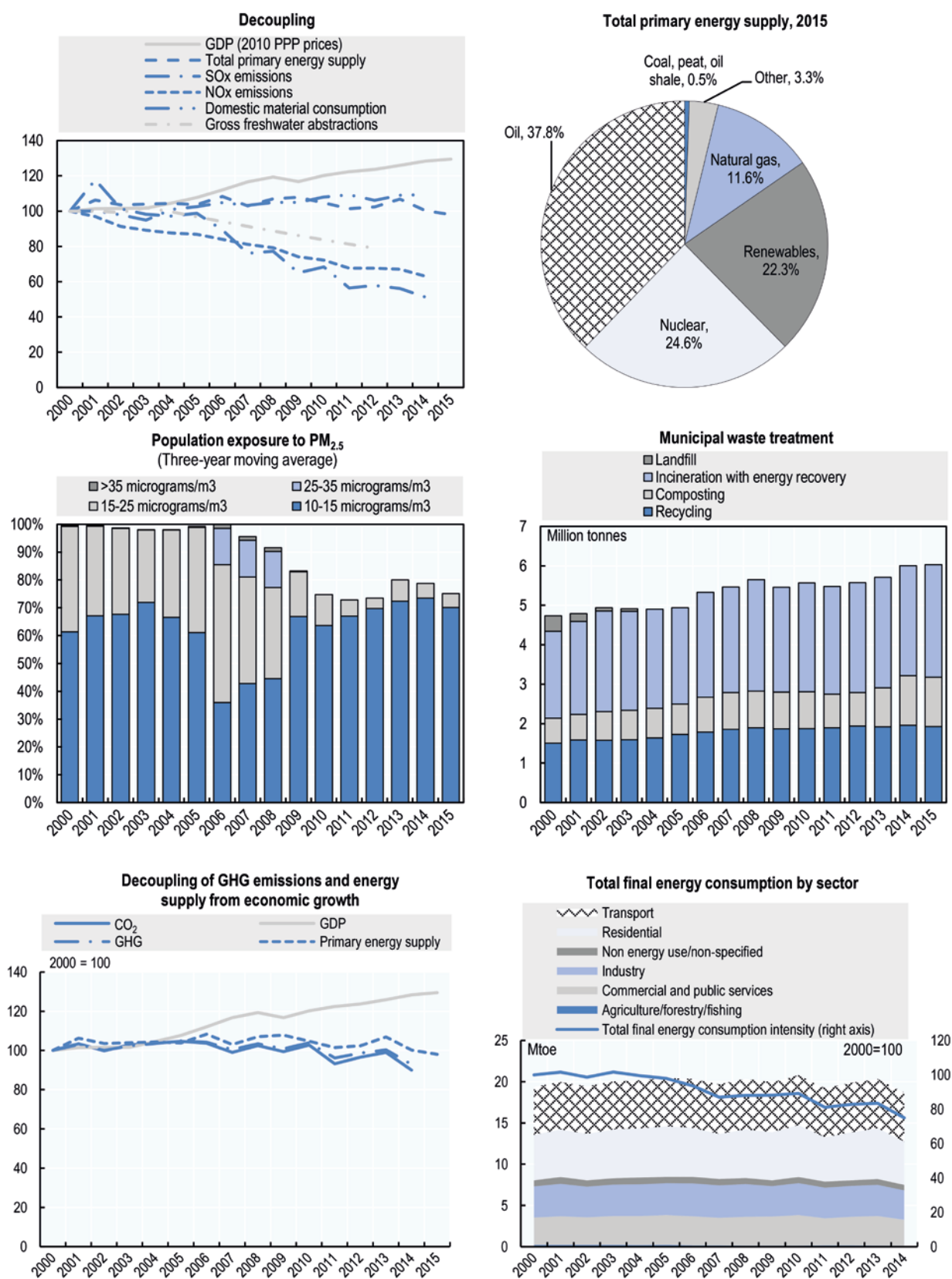
Climate change and energy mix and intensity

Over the past decade Switzerland has achieved the goal of decoupling economic growth from domestic GHG emissions (Figure 1), becoming the top OECD performer in terms of GHG emission intensity. The economy's low carbon intensity stems from high shares of renewable energy resources and nuclear energy in the energy mix and an economy dominated by services (Figure 1). Switzerland has no domestic production of crude oil or natural gas and the share of fossil fuels constitutes less than half of total primary energy supply (TPES), well below the OECD share of 84%. Coal provides a smaller share than in any other OECD country (less than 1%).

The May 2017 popular vote confirming a 2011 decision to gradually phase out nuclear energy necessitates a new energy strategy, including accelerated deployment of renewables, aiming at a significantly higher share in final energy consumption by 2050. In 2015, Switzerland ranked in the first ten OECD countries in terms of renewables' contribution to TPES and in terms of electricity generated from renewable resources. While 60% of the renewable energy supply comes from hydropower, the contribution of all renewables has increased since 2000.

Switzerland was one of the OECD's best-performing countries in terms of energy used by the economy in 2015 (TPES per unit of GDP). Transport is the largest energy consumer, using a third of final energy and over half the fossil fuels in the overall energy supply. To decarbonise the sector, Switzerland aims for a modal shift from road to rail and for improved public transport.

Figure 1. Selected environmental performance indicators



Note: Total final energy consumption is expressed per unit of GDP in 2010 prices and purchasing power parities.
 Source: OECD (2017b), OECD Environment Statistics (database); OECD (2016), OECD National Accounts Statistics (database); IEA (2017a), CO₂ Emissions from Fuel Combustion Statistics (database), IEA (2017b), IEA World Energy Statistics and Balances (database); Eurostat (2016), Material flow accounts (database)

Air quality

Overall, air quality has improved significantly yet not enough to protect people and ecosystems. With the decline in emissions since 2000, including fine particulate matter (PM_{2.5}) (Figure 1), all major air pollutants have been decoupled from economic growth. The main sources now are transport, wood combustion, agriculture and industry. All cantons have drawn up programmes of measures for air protection.

However, in areas of heavy traffic, levels of coarse particulate matter (PM₁₀) and nitrogen dioxide (NO₂) are still above the legal ambient limit values, as are summer ozone levels in rural areas of Ticino canton. Population exposure to PM_{2.5} remains a source of concern (Figure 1). PM and ozone air pollution cause 2 000 to 3 000 premature deaths per year (Roy and Braathen, 2017). Related health costs are estimated at over USD 13.7 billion per year (2.7% of GDP in 2015), mostly from cardiovascular and respiratory diseases. In 2007, Switzerland decided not to renew its first National Environmental Health Action Plan (NEHAP), which had been implemented since 1998. Institutional co-operation between the Federal Office for the Environment (FOEN) and the Federal Office of Public Health has continued since 2007 (for example, in the areas of chemicals and sustainable development), but there is no holistic view of environmental health problems in Switzerland nor an assessment of the costs and benefits of public action in this area. This is unfortunate at a time when NEHAP is becoming increasingly important in other European countries.

There is ample evidence of the impact of nitrogen deposition on biodiversity (Chapter 5). Two-thirds of the nitrogen deposited originates from ammonia, 92% of which comes from agriculture. Switzerland should evaluate the cost-effectiveness of current measures aimed at reducing ammonia emissions from agriculture, which have not been fully successful. Although federal authorities have supported low-emission technology and placed considerable emphasis on low-emission design of barns and yards, ammonia emissions continue to far exceed the critical limit value and have not significantly declined over the past decade, much less met the 40% reduction (from 2005 levels) in the 2009 Federal Air Protection Strategy to address critical loads.

Waste management and circular economy

Switzerland has a very high level of municipal waste per capita – 742 kg in 2015, one of the largest amounts among OECD countries – and municipal waste generation has increased by 27% since 2000 (Figure 1), in line with private final consumption. While municipal waste management policies have been effective in encouraging recycling (Section 3), there is considerable room for improvement when it comes to reducing residual municipal waste. Since 2000, Switzerland has forbidden landfilling of combustible waste and of biodegradable municipal waste. Landfilling has been replaced with incineration and recycling, each of which covers around half of the municipal waste treated.

While waste recycling policies have turned out to be effective, there is still room for closing the loops and moving towards a circular economy. For example, besides excavation material, construction and demolition waste, at over 15 million tonnes per year, is by far the biggest waste stream. Hence the closure of material cycles and recycling clearly make sense in this sector, which so far has achieved 80% waste prevention and material recovery. Introducing extended producer responsibility requirements for construction materials, as in Germany, would create incentives to take end-of-life costs into account in product design (Watkins et al., 2012). Virgin-material taxes could also be considered to stimulate greater use of recycled substitutes; to that end, they should be confined to commodities where international trade is limited due to high transport costs relative to value (e.g. gravel, sand) (Smith, 2014). Another possibility would be to aim for a higher share of recycled materials in construction materials (the share is currently only around 10%).

Construction materials, such as gravel and sand, account for nearly 50% of Switzerland's domestic material consumption (DMC), the largest share in the OECD. In 2013, Swiss DMC productivity, defined as the amount of GDP generated per unit of DMC, was among the highest for any OECD country. Since 2000, however, DMC has increased by 9%, compared with an average decrease of 11% in the European Union (EU).

Water resource management

Switzerland ranks in the middle of the OECD in terms of freshwater resources per capita, and extracts a low share of its available freshwater resources compared to the OECD Europe average. Over the past decade, water abstractions as a share of available resources decreased by over a fifth, meaning reduced pressures on water resources. This is a welcome trend. However, land use intensification threatens the protection of groundwater abstraction areas.

Water quality has a mixed record. The construction of sewage treatment plants has considerably reduced phosphorus and nitrogen pollution in medium-sized and large rivers and lakes. However, micro-pollutants are a rising challenge and water quality in small rivers and aquifers continues to be threatened by diffuse agricultural pollution.

Minimum river flows have received particular attention in legislation, largely due to the importance of hydropower generation. In addition, the structure of watercourses has been profoundly altered over time to gain land for agriculture and building, provide protection against floods and install and operate hydropower plants (Section 4).

Protected areas and biodiversity

Over the last century Switzerland lost a significant part of previously widespread habitats such as alluvial zones, mires, and dry meadows and pastures. Expert assessments indicate that

about half of the approximately 235 Swiss habitat types are classified as endangered (FOEN, 2017a).

In the late 2000s, as much as 79% of reptiles, 62% of amphibians, over a third each of mammals and birds, and over a quarter each of freshwater fish and vascular plants were classified as vulnerable, endangered or critically endangered. Pressures on biodiversity include intensive agriculture, the channelling and use of water bodies for generating electricity, soil sealing, landscape fragmentation and the spread of invasive alien species. Although Switzerland adopted a biodiversity strategy in April 2012, development of the related action plan took longer than expected and its release finally took place in September 2017.

Recent polling showed that a large majority of Swiss believe nature in Switzerland is doing very well (FOEN, 2017a). This misperception of the risks facing biodiversity may contribute to biodiversity protection being given low priority vis-à-vis economic development objectives (Section 5).

Recommendations on air, waste, environmental health and information

Air management

- Further reduce levels and deposition of acidifying, eutrophying and ground-level ozone air pollution below critical loads and levels as set out by the Convention on Long-range Transboundary Air Pollution; to that end, set more stringent emission reduction commitments for ammonia, ozone precursors (nitrogen oxides, volatile organic compounds and methane), sulphur oxides and fine particulate matter (e.g. following the example of EU Directive 2016/2284 for the period beyond 2020) and achieve them in accordance with the polluter-pays principle while ensuring coherence with existing instruments (e.g. instruments to reduce agricultural nitrogen surpluses, EURO standards for vehicles, VOC tax for solvents).
- Implement further measures to combat ground-level ozone in Ticino canton, including via more targeted and time-limited measures during the summer.

Waste management

- Prepare a federal waste prevention strategy including indicative targets for municipal waste reduction.
- Consider developing a national resource efficiency strategy to tackle the issue of high DMC levels; in particular, further improve recycling and material recovery of construction and demolition waste by assessing the cost-effectiveness of introducing measures such as extended

producer responsibility requirements for construction materials similar to those in Germany, a tax on virgin materials extracted in Switzerland (e.g. gravel, sand) drawing on experiences in Sweden, Denmark and the United Kingdom, and a target for the use of recycled building materials.

Environmental health and information

- Consider developing a new NEHAP with a view to cost-effectively tackling remaining health effects of pollution.
- Strengthen efforts to raise public awareness and avoid public misperception of the state of the environment and of the risks facing Swiss ecosystems; to that end, develop public communication campaigns and foster environmental education at the federal and cantonal levels, and promote local awareness-raising approaches (e.g. as part of Local Agenda 21 and Agenda 2030 for Sustainable Development).

2. Environmental governance and management

EU environmental regulations do not directly apply to Switzerland, as the country is not a member of the EU or the European Economic Area, whose non-EU members have agreed to align their environmental legislation with the EU acquis. Switzerland is, however, a member of the European Free Trade Association and has established bilateral agreements with the EU in various areas, including agriculture, public procurement, and air and road traffic. In that context, the country has integrated certain aspects of EU legislation into national legislation, while retaining its prerogatives on environmental policy.

Institutional framework

Switzerland needs to make more efforts to strengthen vertical co-ordination between the Confederation and the cantons. While progress has been made since the 2007 OECD Environmental Performance Review (EPR), a 2013 study commissioned by FOEN revealed that environmental law was not uniformly applied countrywide. Cantons participate in the Conference of Heads of Services for Environmental Protection and similar thematic networks, although they are not involved in all working groups. There are no formal networks for all environmental sectors. FOEN's «enforcement aids», guidelines for cantons to harmonise environmental law, are not always comprehensive or systematically updated (FOEN, 2013a; CCE, 2016).

Regulatory framework

Switzerland lacks strategic environmental assessment (SEA) of plans and programmes. Recent attempts by the government to introduce efficiency evaluation into spatial planning, including elements of SEA, has not yet translated into regulatory reform. Switzerland has a well-developed and effective system of ex ante environmental evaluations. These include regulatory impact analysis to examine the economic and social impact of draft laws, and other types of assessment dedicated to sustainability and the environment, such as the sustainability assessment carried out by the Federal Office for Spatial Development and the economic assessment of environmental legislation, which FOEN carries out. FOEN should ensure consistency among these various procedures (FOEN, 2016a; SECO, 2016).

As the 2007 EPR noted, Switzerland's approach to permitting is in contrast with the EUwide practice of integrated pollution prevention and control for high-risk installations. In most cantons, environmental conditions are prescribed in operating and building permits, which cover some environment-related aspects, such as air, water, waste and noise. There are differences across cantons in the scope and stringency of environmental requirements included in permits. Introducing integrated permits for facilities with a high potential environmental impact and simplified requirements (e.g. general binding rules) for low-risk ones could decrease the administrative burden on the regulated community and favour a holistic approach to pollution prevention (Mazur, 2011).

Compliance assurance

The institutional framework for compliance assurance remains highly fragmented. Cantons are in charge of ensuring compliance with environmental regulations and have discretion in the means of achieving it, which leads to significant discrepancies among cantons. Inspections are not integrated across environmental media, except in some cantons where site visits may be conducted jointly by inspectors responsible for different environmental issues.

The Environmental Protection Act (EPA) provides for administrative injunctions and orders of corrective action in response to non-compliance. It also stipulates criminal sanctions for serious offences, which are low compared to other OECD countries. Cantons can impose administrative fines, but the definition of the violation and amount of fine for a given offence can vary widely by jurisdiction. Environmental police exist in most cantons and can initiate prosecution, as can public prosecutors. However, the latter generally lack awareness and technical expertise on environmental matters, weakening criminal environmental enforcement (Petitpierre, 2015).

Switzerland has about 38 000 contaminated sites, of which 15 000 need investigation to assess their environmental status. It is estimated that 4 000 need remediation. Remediation of

severely contaminated sites (e.g. hazardous waste landfills) was completed in 2017. Operators are required to deposit a financial guarantee that would cover potential investigation and remediation costs. In accordance with the 2000 Ordinance on the Charge for the Remediation of Contaminated Sites, Switzerland has a financing mechanism for remediation of contaminated sites. It consists of a special fund, financed by a charge on landfilled waste, that provides cantons and municipalities with partial repayment (40%) of remediation costs. Switzerland has strict (no-fault) liability for environmental damage. The EPA mandates remediation of contaminated sites and their inventory in publicly available cantonal registers. However, it does not specify environmental damage to any element of the environment.

Voluntary agreements to achieve environmental goals are widely used. In the energy sector they are carried out through specialised agencies that help enterprises meet cantonal targets on energy efficiency. For example, the Swiss Association of Waste Treatment Facility Operators aims at reducing CO₂ emissions from waste incineration among its members and increasing plant efficiency in exchange for exemption from the national emission trading system (ETS).

There is substantial room to strengthen green public procurement, an area currently lacking a policy framework and targets. Promotion of green practices through guidance documents and advice is not systematically applied at the federal level. More should also be done by cantons to promote compliance with environmental law, which reduces social and regulatory costs, especially among small and medium-sized enterprises (SMEs) (OECD, 2015a).

Environmental democracy

Switzerland has a long tradition of enabling citizens to express their concern about environmental issues through referendums and popular initiatives. These instruments of direct democracy are useful in engaging the public in environmental debates and giving an impulse to the government's policy making. In a referendum on 21 May 2017, Swiss voters approved amendments to the Energy Act that pave the way for the gradual phase-out of nuclear energy, reduced energy consumption and increased reliance on local renewable energy sources. However, out of some 20 referendums that have been held since 2000 in relation to environmental issues, only 6 were approved.

Over the last decade, significant progress has been made in including sustainability issues in education curricula. Education21, a recently established national centre for sustainable development education, provides pedagogical and financial support to teachers and institutions (Education21, 2016).

The government has improved public access to environmental information. As recommended in the 2007 EPR, Switzerland ratified the United Nations Economic Commission for Europe (UNECE) Convention on Access to Information, Public Participation in Decision-

making and Access to Justice in Environmental Matters (Aarhus Convention). After ratification, the EPA was amended to define the type of environmental information that federal and cantonal authorities must provide to the public. The state of the environment is assessed every four years in a report adopted by the Federal Council (the Swiss government). Access to justice is ensured through a right to appeal any federal or cantonal decision; appeals can be brought by anyone directly affected by such a decision.

Recommendations on environmental governance and management

Vertical co-ordination

- Harmonise and strengthen environmental policy and law implementation across cantons by improving vertical co-ordination, promoting regular performance monitoring mechanisms and indicators; continue to disseminate best regulatory practices across cantons.

Regulatory framework

- Consider introducing integrated environmental permits for large industrial installations, based on best available techniques, to move towards a holistic approach to pollution prevention; simplify the regulatory regime for low-risk installations by introducing sector-specific general binding rules.
- Introduce requirements for SEA of plans and programmes; ratify the UNECE protocol on SEA.

Compliance assurance and promotion

- Improve the effectiveness and efficiency of compliance monitoring by strengthening risk-based inspection planning and developing guidelines for specialised inspection services; promote integrated inspections across environmental media.
- Develop federal guidance to cantons on the use of enforcement tools; strengthen sanctions for non-compliance with federal environmental regulations; consider introducing prosecutors specialised in environment or provide environmental training to public prosecutors to facilitate criminal enforcement.
- Improve the system of liability by defining damage to specific environmental media.
- Encourage voluntary compliance and diffusion of green practices among enterprises by providing sector-specific guidance, especially to SMEs, and offering incentives for environmental

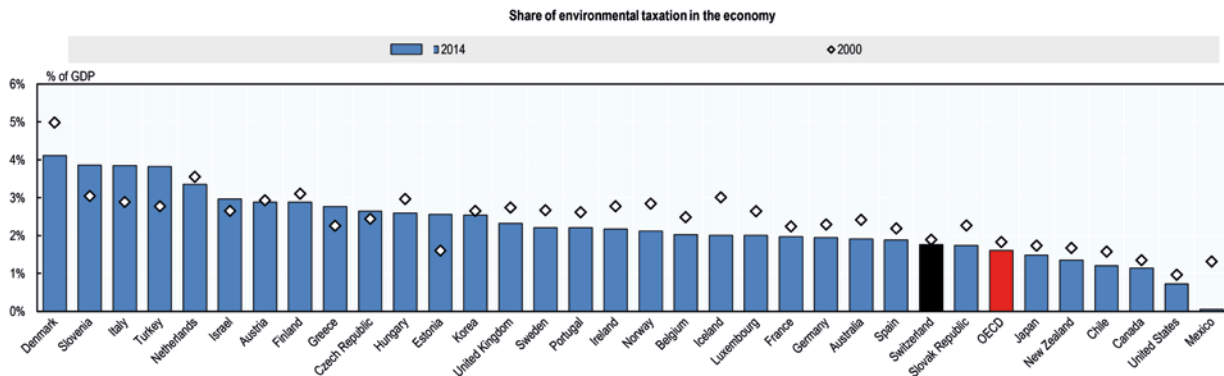
management system certification; strengthen green public procurement by setting targets and monitoring their achievement.

3. Towards green growth

Switzerland has made progress in greening its economy, as illustrated by its above-average performance on some green-growth-related indicators, but it has opportunities to do more. These include, in particular, shifting to a coherent green tax system to address consumption-related environmental effects, greening public procurement as well as the investment practices of its prominent corporate and financial sector, fostering eco-innovation, and aligning its trade and environmental policies.

Green economy framework and overall performance

Acknowledging the need to further green the economy, the Federal Council adopted a well-defined Green Economy Action Plan (GEAP) in 2013; its 2016-19 variant remains the centrepiece of the green economy strategy. It is focused on three priority areas: consumption and production, waste and raw materials, and cross-cutting instruments. While the GEAP considers that existing policies (e.g. on energy, climate, spatial planning) already help reduce the economy's environmental impact, its links with other strategic policy processes, such as Energy Strategy 2050 and the four-year Agriculture Policy packages, could be clarified. Successive votes by the parliament (2015) and general public (2016) turned down more extensive and binding green economy measures, which were perceived as too radical and potentially harmful to the economy. The incremental, step-by-step approach favoured by authorities, the business sector and voters alike might prevent more ambitious and transformational commitments.

Figure 2. Environmental taxation is low and decreasing

Source: OECD (2017c), OECD Database on Instruments Used for Environmental Policies and Natural Resources Management (database).

Greening the tax and incentive systems

Accrued total tax revenue is equivalent to 27% of GDP, a percentage that has remained stable and is significantly lower than in neighbouring European countries. Accrued environmentally related tax (ERT) revenue was equivalent to 1.8% of GDP in 2014 (the percentage was stable over the review period), slightly higher than the OECD average (Figure 2) but below the OECD Europe average (2.5%). Unlike in most OECD countries, where energy typically dominates ERT, the share of transport-related revenue rose steadily to nearly half. The 2007 EPR recommendation to implement green tax reform was envisioned by the first Sustainable Development Strategy in 2002, but Switzerland appears to face political difficulties when it comes to carrying out such reform at scale. For instance, a range of environmentally harmful subsidies and tax exemptions remain in place. Nevertheless, some ERTs and fees have proved at least partly effective.

A major achievement is the 2008 introduction and increase of a CO₂ tax on heating- and process-related fossil fuels, which was CHF 84 per tonne (about EUR 77) as of January 2016. While this positions Switzerland among front runners in terms of tax rate, the tax base does not cover road fuels. Instead of planning a gradual increase in the tax rate, as the EU advocates, future increases would depend on the evolution of CO₂ emissions. Companies liable for the tax may be exempted if they voluntarily commit to uninterrupted emission reductions by 2020, but eligibility criteria are lax, as applicants propose targets themselves based on «economically viable reduction potential». In parallel to the CO₂ tax, Switzerland set up its ETS, but as of 2016 it only covered 55 companies accounting for 11% of national emissions. Furthermore, while the price of CO₂ emission allowances was as high as CHF 40.25 per tonne in May 2014, a regulation brought it down to CHF 6.5 in March 2016, much closer to the price in the EU ETS.

Over 2008-13, some 2.5 million to 5.4 million tonnes of GHG reduction was achieved, which represents only 1% to 2% of the emissions Switzerland reported under the United Nations Framework Convention on Climate Change over the period (FOEN, 2016b). The CO₂ Act sets a 20% domestic GHG target by 2020 and Switzerland has submitted a well-defined Intended Nationally Determined Contribution setting a GHG reduction target of 50% by 2030. Despite the relatively strong price signal provided by the CO₂ tax, the combination of a low carbon price under the Swiss ETS (potentially worsened by the expected link with the EU ETS) and the ease of benefiting from CO₂ tax exemption make reaching these objectives challenging. The heavy reliance of the 2030 indicative target on international offsetting leaves the door open to relatively modest domestic efforts.

In 2011, after the Fukushima accident, the parliament undertook to reform Swiss energy policy and asked the Federal Council to prepare an energy strategy to foster a shift from nuclear power to renewables by 2050. In 2013 the government submitted a first package of Energy Strategy 2050 measures. On 30 September 2016, the parliament prepared the necessary amendments to the Energy Act, which were approved by referendum on 21 May 2017 (Section 1). The first package, covering 201820, provides financial support, via levies on electricity bills, to cover part of the cost of investment in renewables. Electricity consumers also subsidise renewables development via market premium and market price support (feed-in tariffs). This means electricity consumers will assume the cost of the energy transition. The Energy Act underwent a referendum because the policy involves a differentiated financial effort between households, small and medium-sized enterprises (SMEs) and large firms to support the energy transition. The case of a CHF 00.023/kWh supplement on electricity bills paid exclusively by households and SMEs (and reimbursed to large firms) is an illustration of this.

Looking ahead to 2021 and the second stage of Energy Strategy 2050, the government has begun to explore options for shifting the basis of the energy transition policy from support by electricity consumers to tax incentives related to energy and climate. On 28 October 2015, the Federal Council sent the parliament a draft of the required constitutional amendment for consideration. However, the National Council (lower house) decided on 8 March 2017 not to examine the proposal. Similarly, the Council of States (upper house) rejected it in June 2017. Switzerland should consider ways to expand the CO₂ tax base and address misalignments between climate change objectives and policies in the areas of investment, taxation, innovation, urban mobility and forestry, to name a few.

A long-standing area of concern relates to freight transport through the Alps. To reduce the associated environmental impact, in 2001 Switzerland introduced a distance- and weight-based tax on goods vehicles above 3.5 tonnes. The tax provides a better incentive to reduce air pollutant emissions than the Eurovignette in Belgium, Denmark, Luxembourg, the Netherlands and Sweden, which is not distance-based and applies only to goods vehicles above 12 tonnes. The Swiss tax further differentiates rates to provide incentives to meet more recent and stringent EURO emission standards and undertake diesel particle filter retrofits. Such

differentiation has been effective in leading to renewal and upgrade of the heavy goods vehicle fleet (FOT, 2016). The tax also contributed to progress in the modal shift of freight from road to rail. But Switzerland remains far from reaching its goal of a maximum of 650 000 trucks crossing the Swiss Alps per year by 2018. Despite a 30% reduction over 2000-14, 1 million heavy goods vehicles travelled through the Alpine region in 2015 (FOT, 2016). With the December 2016 opening of the Gotthard Base Tunnel, the world's longest rail tunnel, the share of freight travelling by train is expected to rise further. However, meeting the 2018 target also depends on efforts to shift freight from road to rail in other countries. For instance, France and Austria have achieved much lower shares of rail in their transalpine freight transport.

As regards road fuel taxation, Switzerland is one of the few OECD countries that tax diesel fuel at a higher rate than petrol, which makes environmental sense given diesel's higher carbon and air pollutant emissions. However, the 2007 EPR recommendation to increase the tax levels for both fuels so as to further improve pricing of environmental externalities has not been met. A possible extension of the CO₂ tax base to include road fuels, which falls within the scope of the CO₂ Act, was considered but a parliamentary consultation led to its abandonment because of public opposition. Switzerland imposes a penalty on imports of cars that do not comply with a per-kilometre target for CO₂ emissions, however.

Switzerland has been pilot testing mobility pricing, as mandated by the Federal Council in its 201115 term. Consultations conducted in 2015 revealed that the majority of cantons and civil society are favourable to the principle of mobility pricing, which could include incentives to travel outside the peak traffic hours and be differentiated based on vehicle emission standards.

As Switzerland does not produce crude fossil fuels, its support to fossil fuels only concerns industrial and final consumption (OECD, 2015b; OECD, 2013). The annual support was estimated at CHF 260 million in 2014, exclusively in the form of tax expenditure (refunds and exemptions). This places Switzerland among OECD countries with a relatively low ratio of tax exemptions for fossil fuel consumption to total tax revenue (0.1%, compared to the OECD average of 0.4%). Even so, removing such exemptions would free resources that could allow the current public support to renewables development to double. Furthermore, a noticeable trend in fossil fuel subsidies is the growing share represented by CO₂ tax exemptions, a consequence of the gradual increase of the tax rate.

The level of agricultural policy support remains among the highest in the OECD in terms of transfers from consumers and taxpayers as a share of gross farm receipts. However, Switzerland has pursued the significant agricultural policy reforms initiated in the mid-1990s, in particular by redirecting budgetary support from production to the provision of environmental services. The proportion of payments with explicit environmental objectives increased from 6% in 2000 to 23% in 2015. In particular, under Agriculture Policy 2014-17, the payments increasingly focus on preserving agricultural landscape and biodiversity. Another important policy change was replacing headage payments with grassland area payments for dairy cows. The former had

encouraged intensification of livestock farming, although the latter is conditional on minimal stocking density. Under Agriculture Policy 2014-17, direct payments continue to be subject to environmental cross-compliance (i.e. farmers must show proof of ecological performance to be eligible). However, enhancing cost-effectiveness of payments would require targeting them to local ecological conditions and restricting them to provision of well-identified and otherwise unremunerated public goods and services. This is not the case with environmental cross-compliance, which only acts as a threat for non-compliance with environmental regulations regardless of local conditions.

Together with continuously increasing volumes of road transport, municipal solid waste (MSW) illustrates Switzerland's difficulties in reducing the environmental impact of consumption. A pay-as-you-throw system involving a fee per bag used, also called a bin-liner fee, was introduced in 1997 and is now in place in 90% of municipalities. Under the EPA (Article 32a), the fee pursues the goal of full cost recovery (i.e. fees should cover all MSW disposal costs, including capital depreciation). Waste-stream-specific fees (e.g. for beverage containers, batteries) and extended producer responsibility programmes (for electrical and electronic equipment) are also in place. This mix of instruments, combined with the prohibition on landfilling combustible waste, has significantly increased MSW recycling rates. However, it has prevented neither a renewed heavy reliance on incineration nor a continuous increase in MSW generation per capita, which remains significantly above the OECD average.

Public investment in support of a greener economy

Government environmental protection expenditure (EPE) slightly increased over the review period to CHF 4.3 billion in 2014 or around 0.7% of GDP, in line with the EU average. The rise in EPE on air and climate may reflect increased efforts to curb CO₂ emissions following introduction of the CO₂ tax in 2008. The steady decrease of EPE on sewage since 2000 reflects the decreasing investment need for sewage treatment plants, as they are already equipped with tertiary treatment, although upgrades to better treat micro-pollutants have begun. More generally, the government expects an increase in EPE as well as broader environmental expenditure due to ageing infrastructure, population growth and urbanisation (including urban sprawl). This raises the question of how to meet financing needs without increasing the government debt/GDP ratio.

Looking at the greening of infrastructure investment beyond traditional environmental protection and infrastructure, Switzerland has taken notable policy steps regarding renewables, energy efficiency in buildings and sustainable transport. Indeed, the planned nuclear phase-out requires identifying and implementing cost-effective renewables capacity and energy efficiency improvement at scale to avoid an increase in the GHG intensity and import dependence of the energy mix. When making such investments, potential environmental effects should be taken into account, particularly in protected natural areas.

In terms of new renewables capacity (in addition to further reliance on hydropower), however, Switzerland appears to have voluntarily aimed at slow deployment. While the feed-in tariffs (FITs) introduced in 2009 reached their initial goal of triggering development of new renewables-based power capacity (Fondation RPC, 2016), by 2014 only 3% of the electricity produced benefited from FITs (OECD, 2015c). Faster deployment is needed if Switzerland is to meet its climate goals while phasing out nuclear energy. The introduction of a one-off investment grant (as an alternative to FITs), and reduction of the FIT level and payment period (from 20 to 15 years) for renewables-based energy projects, however, underlines the will to avoid windfall profits and the cost burden of excessive long-term payment commitments. As of 2018, under the first package of measures of Energy Strategy 2050, Switzerland will replace the existing FITs with private contracts (contracts for difference) and introduce additional investment grants, thereby moving to solutions that are even more responsive to changing market conditions.

Turning to energy efficiency in buildings, Switzerland launched a joint federal-cantonal programme for energy efficiency in buildings in 2010. The subsidies for refurbishment achieved their reduction target, but the cantonal programme fostering the use of renewables and waste heat underachieved due to difficulties in mobilising matching funds. Nevertheless, the programme's cost-effectiveness (estimated at CHF 65 per tonne of CO₂ avoided after four years) exceeded expectations (Federal Council, 2016). In the context of Energy Strategy 2050, the parliament prolonged the programme beyond 2019 and increased the maximum amount earmarked for it to CHF 450 million per year, lowering the cantonal share and thus potentially addressing part of the cantonal funding shortfall. For both the buildings programme and support to renewables, reliance on earmarking (of the CO₂ tax and the grid tax, respectively) poses financial sustainability and redistribution issues.

Mobilising the corporate and financial sectors

The Swiss economy features large companies and a sizeable financial industry. Taking further steps to promote mainstreaming of environmental considerations into business and investment decisions, as well as to mobilise private participation in green investment, could yield significant environmental benefits domestically and internationally. Switzerland is proactively engaged in multiple international voluntary initiatives, in particular towards promoting ideas and options for making financial systems more sustainable (e.g. G20 Green Finance Study Group, Financial Stability Board Task Force on Climate-related Financial Disclosures). Domestically, it has established a dialogue with the financial sector to promote integration of environmental criteria in financing and investment decisions of players in the Swiss financial market.

Despite these initiatives, a FOEN-commissioned study (South Pole Group, 2015) estimated that the asset holdings of the Swiss equity fund market contribute to a global temperature increase scenario of between 2°C and 4°C above the Paris Agreement 2°C target. More generally, the share of assets managed according to environmental criteria remains negligible despite

growth in recent years (Swiss Sustainable Finance, 2016), necessitating more ambitious goals and prompt action. Transparency and reliability of information on the environmental performance of business and financial sector investment are essential for consumers and market participants. More concrete actions in this area should be taken in the short term, both domestically and internationally, beyond reliance solely on voluntary approaches.

Fostering eco-innovation

Switzerland has continued to strengthen its overall international competitive advantage in science, technology and innovation, based on proactive and collaborative policies (OECD, 2014). This includes well-defined master plans for environment and energy research with themes of direct relevance to the GEAP, as well as efficient co-operation with the private sector fostered through voluntary economic-environmental collaboration. This has resulted in particularly high levels of process-related eco-efficiency improvements and demand for eco-innovation in the business sector. These elements support Switzerland's above-average production-based energy, GHG and material productivity, but are only partially captured by patent counts and narrow sectoral definitions of eco-innovation.

Nevertheless, Switzerland ranks low among OECD countries in the share of environment-related activities in its overall government research and development (R&D) budget (OECD, 2017d). Moreover, the share of environment-related patents has been lower than the OECD and OECD Europe averages since the mid-1990s (OECD, 2017e). Both trends could be explained in part by a policy shift towards non-thematic research, to which Switzerland devotes the highest public financial support in the OECD. However, there appears to be a specific funding gap on eco-innovation in the pre-commercialisation and demonstration phase due to a combination of limited public support beyond the prototype phase and a relative absence of domestic private-sector industrial champions. Switzerland holds a better relative position in the pharmaceutical and biotechnology industries in terms of both public R&D investment and patent-related revealed technology advantage (OECD, 2014). By maintaining a policy focus on short-term competitiveness, exempting GHG-intensive SMEs from the CO₂ tax increases the risk of them lagging behind in terms of low-carbon innovation and performance in the longer term.

Mainstreaming the environment in development co-operation and trade practices

Net official development assistance (ODA) has more than tripled at current prices since 2000, enabling Switzerland to meet the parliament's 2011 goal of reaching 0.5% of GNI by 2015, although this remains below the United Nations target of 0.7%. An increasing share of bilateral ODA addresses global and local environmental objectives (in particular climate change adaptation), probably at least in part due to the establishment of a common platform on international financing and development co-operation by the Swiss Agency for Development

and Co-operation, the State Secretariat for Economic Affairs (SECO) and FOEN. Switzerland intends to enhance the mobilisation of its prominent private sector in support of international development and climate action, but has not yet laid out a clear strategy and concrete action plan to do so.

Ensuring coherence between trade and environmental policies is of utmost importance given the reliance of the economy on imports and exports. Since 2014, Switzerland has been one of the 17 World Trade Organization members negotiating an environmental goods agreement. In addition, the 2013 GEAP assigned SECO, in consultation with FOEN, the task of evaluating the environmental impact of free trade agreements (FOEN, 2013b). However, no free trade agreement has been subject to evaluation, even though opportunities to do so arose. Furthermore, SECO intends to decide whether to undertake evaluations case by case (Swiss Confederation, 2016). Such evaluations should be done much more systematically, especially given the particularly high share represented by imports in the environmental impact of final domestic demand.

Recommendations on green growth

Green economy framework

- Further strengthen inter-office collaboration to promote GEAP as a whole-of-government approach; foster coherence of GEAP with relevant plans and strategies, e.g. Energy Strategy 2050, Action for Corporate Social Responsibility, Sustainable Development Strategy.

Greening the tax and incentive systems

- Consider ways to widen the CO₂ tax base and strengthen efforts to align sectoral and macroeconomic policies for a low-carbon economy; this should include the phasing out of remaining tax exemptions and rebates for fossil fuel consumption, including to free budgetary resources for further developing renewables and improving energy efficiency.
- Expand incentive-based taxation to reduce the environmental impact of consumption; in particular, consider introducing mobility pricing and making the bin-liner fee an incentive-based instrument rather than one aimed at recovering the costs of MSW disposal.
- Pursue efforts to make direct payments to farmers linked to the provision of well-identified and otherwise unremunerated public goods and services as a means of contributing to absolute decoupling between agricultural production and the environmental performance of agriculture.

Public investment in support of a greener economy

- Maintain or strengthen the polluter-pays principle to finance needed investment (e.g. in sewage treatment plants) due to ageing of environmental infrastructure, population growth and urbanisation, via an increase in corresponding charges, as necessary to ensure cost recovery.
- Further adjust the conditions for benefiting from support to changing market conditions in order to optimise the cost of the transition from nuclear power to renewables; for instance, applicants could be required to demonstrate that their investment would not be made in the absence of support.
- Ensure that earmarking of ERT revenue is bound to defined objectives and periods; the reliance of support to renewables and the energy efficiency in buildings programme on earmarking (of the grid tax and CO₂ tax, respectively) should, for instance, be reduced over time in order to increase flexibility of tax revenue allocation based on changing market conditions and spending needs.

Mobilising the corporate and financial sectors

- Take concrete steps to more systematically monitor, and create incentives for improvement in, the environmental performance of investments made by the financial sector; exclusion of environmentally harmful (e.g. fossil-fuel-related) activities from asset holdings and mandatory disclosure regarding the alignment of financial flows with international climate agreements could initially be implemented and tested with publicly owned entities, then progressively rolled out, which could significantly speed the sensitisation of the financial sector, leading to behaviour change at scale.
- Public-private partnerships between federal or subnational authorities and the financial sector could be further explored to mobilise private finance for greener infrastructure investment in renewables, energy efficiency and sustainable transport.

Fostering eco-innovation

- Take better advantage of Switzerland's world-leading strengths in research and innovation to reposition the country as a front runner in eco-innovation; concrete steps could include rejuvenating public support for eco-innovation, especially in the demonstration and early commercialisation phases, for which the well-working Swiss venture capital market could be better utilised.

Mainstreaming environment in development co-operation and trade

- Maintain, and consider strengthening, the common platform on international financing and development co-operation regarding the environment as a key enabler for Switzerland to meet its international ODA-, climate- and biodiversity-related financial commitments.

- Make evaluation of the environmental impact of any new trade agreement a requirement rather than relying on ad-hoc considerations; the yet-to-be-negotiated free trade agreement between MERCOSUR and the European Free Trade Association (which includes Switzerland) provides an opportunity to do so; in addition, consider options for greening the Swiss export credit agency's portfolio.

4. Water management

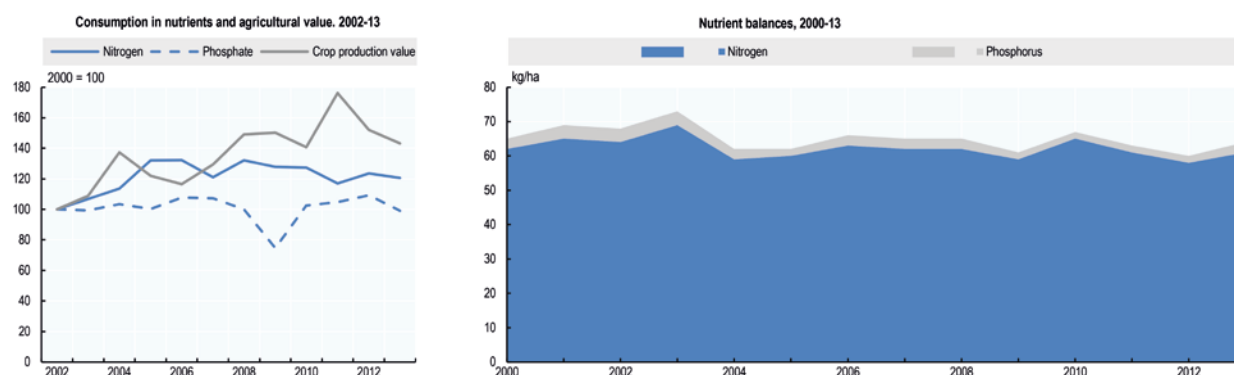
Status, trends and pressures

A large number of micro-pollutants have been detected in Swiss surface waters. In many medium-sized and large watercourses, their main source is urban sewage. A special observation campaign in 2015 revealed that many small rivers carried pesticides from diffuse sources, regularly causing ecotoxicological quality criteria to be exceeded. Even at very low concentrations, micro-pollutants can have adverse effects on aquatic ecosystems (e.g. feminisation of male fish by hormonally active substances) and possibly on human health. Measured levels of micro-pollutants in Swiss drinking water do not currently indicate unacceptable risk to the population (Gälli et al., 2009). However, over 30 000 potential micro-pollutants are in daily use in industrial, commercial and domestic applications as ingredients in plant protection products, biocides, pharmaceuticals and consumer goods such as body care and cleaning products. In 2006, FOEN initiated a survey of micro-pollutants in watercourses, focusing on substances in urban sewage. But there has as yet been no systematic overview of the quantities, uses, emissions, behaviour in the environment and toxicity of these substances, whose number and use are likely to rise due to increases in population and life expectancy (Gälli et al., 2009).

The National Surface Water Quality Monitoring Network (NAWA) reveals a mixed picture of the state of Swiss watercourses (FOEN, 2017b). Nutrient loads have been reduced overall but remain too high at almost 10% of NAWA stations; the share would be much higher if NAWA covered more small rivers, which account for about 75% of the Swiss river system and are particularly exposed to agricultural pollution. Rivers' ability to preserve aquatic biodiversity (invertebrates, aquatic plants) is insufficient for at least 40% of NAWA stations, and only a quarter of stations have sufficient water quality for fish. Moreover, despite efforts to remove phosphorus from sewage, half the 20 largest Swiss lakes still suffer from eutrophication and lack of oxygen, some of them to the point of having to be artificially ventilated. Lakes in areas of intensive farming are particularly affected. A national overview of the several thousand small lakes has not yet been done despite their importance for biodiversity. Some 60% of national groundwater monitoring stations on open land, where intensive agriculture prevails, have nitrate concentrations above 25 mg/litre.

Sewage treatment has reached a very high level: 97.3% of the population is connected to a sewage treatment plant, second only to the Netherlands in the OECD. The proportion of plants achieving tertiary treatment (nutrient removal) increased over the review period to 70% of sewage treated. However, the national nitrogen balance, calculated using OECD methodology, has been relatively unchanged since 2000 (Figure 3). At around 60 kg/ha of agricultural land, the Swiss nitrogen surplus is relatively high by OECD standards.

Figure 3. Agricultural nitrogen remains a source of concern



Note: Nutrient balances and consumption are expressed in kilograms per hectare of agricultural area. Crop production value is expressed in USD at 2010 prices and purchasing power parities.

Source: FAO (2017), FAOSTAT (database); OECD (2017), "Agri-environmental indicators: nutrients", OECD Agriculture Statistics (database).

Around 40% of Swiss rivers (50% of those below 600 metres) are significantly modified as a result of intensified land use, leading to profoundly altered watercourses with consequences for ecosystem functioning. Over time, land use intensification has profoundly altered the structure of watercourses for long stretches. Many streams and rivers have been developed or altered to meet increasing land requirements or to protect populated areas from flooding. As a result, the space for watercourses has narrowed in many places, sometimes to only a drainage channel. In addition, a high degree of fragmentation by artificial structures affects the passage of migratory fish, changes the natural habitat distribution within rivers and modifies their ecological capacity. More than 100 000 artificial obstacles over 50 cm high hinder the free upstream and downstream movement of fish. Hydropower production also influences river flows and causes structural changes in waters. For example, when producing peak energy, storage plants cause sudden artificial variations in flow (hydropeaking) in downstream waters. The numerous structures designed to provide protection against floods, produce energy and gain land for agriculture or building have resulted in a quarter of the total length of Swiss rivers (15 000 km out of 60 000 km) having poor ecological structure. Moreover, growing urbanisation threatens protection zones

around groundwater abstraction areas intended for drinking water supply, which sometimes requires the closure of drinking water supply stations or prevents the creation of new stations.

Strategic framework

While initiating the monitoring of micro-pollutants in water and their ecotoxicological impact, Switzerland decided to apply the precautionary principle and start reducing micro-pollutant discharges into water bodies. It is one of the first countries implementing a national policy to reduce micro-pollutants in municipal sewage treatment plant effluents. As conventional plants are not equipped to treat micro-pollutants, in 2016 Switzerland began equipping approx. 120 plants to remove them. In this, it is also a front runner. Plant selection has been based on the risk of micro-pollutant discharge into the sea (an upstream responsibility), into rivers with low dilution capacity and into water bodies feeding drinking water reservoirs. This policy should lead to halving urban micro-pollutant discharges to rivers by 2040. Switzerland also plans to halve the risk to soil fertility, water quality and terrestrial and aquatic life associated with plant protection product toxicity within ten years following the adoption of a plant protection product action plan. Such a has been approved by the Federal Council on 6 September 2017; this is an area where Switzerland lags behind the European Union (Directive 2009/128/EC required EU countries to draw up pesticide action plans by 2012).

Another major strategic goal of water policy, triggered by a popular initiative, is to rehabilitate the natural functioning of surface waters (rivers, streams and lakes), which is a long-term endeavour. To this end, three amendments were made in 2011 to the Waters Protection Act (WPA). First, it became mandatory for the cantons to provide sufficient space for all surface waters to ensure their natural functioning, including flood control. The space reserved for water can at most be farmed in a way that promotes biodiversity. Second, a national target was set to rehabilitate about 25% of waters with poor morphological status in the next 80 years, i.e. some 4 000 km of river length by about 2090. Third, Switzerland decided all its installations related to hydropower use must reduce their negative impact on watercourses (hydropeaking, changes in sediment transport and obstacles to fish migration) by 2030.

Enforcing protection of groundwater abstraction areas is another major challenge. Some 80% of drinking water originates from groundwater. For several years, Switzerland has worked to protect groundwater with land use planning measures. However, protection of abstraction areas is proving increasingly difficult because of growing pressures from land use intensification.

Urban sewage treatment and micro-pollutant removal

Switzerland has a clear set of water charging principles and widespread metering, which have allowed high cost recovery levels for water supply and sanitation services. The water bill

covers the full costs of operation and maintenance and 78% of long-term capital expenditure (including renewal) of sanitation infrastructure. The WPA requires holders of water facilities to set up the reserves necessary to ensure long-term financing of not only the initial investment, but also its depreciation and renewal. Switzerland should continue to pursue full cost recovery, with water tariffs alone being sufficient to cover all costs, including capital depreciation.

A fund was created in 2016 to cover up to 75% of the cost of upgrading sewage treatment plants through to 2040. It is financed by a federal sewage charge levied on all «central» (large and medium-sized) treatment plants. The Federal Council sets the charge rate, basing it on the expected upgrade cost. Thus the charge is conceived as a revenue-raising instrument rather than an incentive for households to reduce micro-pollutants. The charge level is also based on the number of people connected to the plant, and has a ceiling of CHF 9 per capita per year. The charge is consistent with the polluter-pays principle because plants can pass it on to those connected.

However, in the case of about 15% of central plants (approx. 120 out of the total of 800), almost the entire Swiss population pays for the upgrades. This enlarged charge base allows better cost sharing among those connected, but the polluter-pays principle would better apply if the charge were applied at the watershed level, as in England and Wales. Industrial sewage treatment plants should also fall under the risk-based upgrade requirement and pay the charge. The federal sewage charge could usefully be extended to conventional water pollutants, as is the case in several OECD countries. Such pollution charges create incentives to reduce direct discharges to water bodies, including from sewage treatment plants.

Some 90% of municipalities have prepared a water drainage plan, which was required by the end of 2016 under the WPA. By fostering separate treatment of municipal sewage and storm water, such plans can help improve sewage treatment plants' performance. Separate treatment of storm water also limits direct discharges of micro-pollutants to water.

Nutrient and pesticide management in agriculture

More than 95% of Swiss farms comply with environmental cross-compliance requirements, strengthened in 1999, which limit farm nitrogen and phosphorus surpluses to 10%, prohibit pesticide use on buffer strips of 6 m along rivers (compared to 3 m under the WPA) and require setting aside at least 7% of the farm for biodiversity promotion. However, none of the nutrient and pesticide-related targets published jointly in 2008 by FOEN and the Federal Office for Agriculture (FOAG) has been fully met (FOEN and FOAG, 2016). Hence the Federal Council considered introducing tax incentives in Agriculture Policy 202225 to improve agricultural nutrient and pesticide management. A prerequisite would be to further reduce reliance on payments based on input and output use, which tend to incentivise the use of farm inputs. In addition, Switzerland should assess the cost-effectiveness of the payments farmers continue to

receive for undertaking measures to prevent runoff and leaching of nutrients and pesticides. This WPA provision (Article 62a) should be seen as a transitional measure as it contradicts the polluter-pays principle (i.e. it is about paying farmers to comply with limit values also set by the WPA).

The compulsory computing system for farm manure, compost and nutrient-rich digestate from biogas plants, introduced in Agriculture Policy 2014-17, is a cost-effective way to meet the legal requirement for balanced use of nutrients on farms. It allows nutrient trading at no cost to the public purse other than operating the electronic nutrient trading platform, as farms exchange nutrients only if both the donor and recipient find it to their interest. To further enhance cost-effectiveness, nutrient trading could be combined with a tax levied on surplus nitrogen at the farm level, as Denmark does.

In the context of the forthcoming plant protection product action plan, Switzerland is evaluating the feasibility of introducing a pesticide tax. Such a tax should be differentiated according to toxicity, as is the case in Denmark, and levied on wholesalers or industry to reduce transaction costs. A prerequisite would be to abolish the value added tax concession that still prevails on pesticides.

River system rehabilitation

Cantonal surface water rehabilitation plans were finalised in 2014. They aim to designate stretches of river and lakeshore where the benefits to nature and landscape are greatest in relation to rehabilitation costs. The cost-benefit analysis is based on a stretch's ecomorphological status, its natural state and existing installations, such as buildings and roads, on riparian zones. However, the criteria for selecting river and lakeshore stretches for rehabilitation should be more conducive to reducing fragmentation of water-dependent ecosystems and explicitly aim at creating ecological corridors.

Several legal provisions allow for payments to landowners for the multiple ecosystem services of surface water rehabilitation in terms of hydrology, flood protection, protection of nature and landscape, and land improvement. For example, there may be payments for (i) rehabilitation within the meaning of the WPA, (ii) flood protection under the Watercourse Management Act, (iii) alluvial biotope restoration under the Act on the Protection of Nature and Cultural Heritage and (iv) extensive farming and land improvement under the Agriculture Act. Switzerland should ensure synergies and coherence between these payments. This would mean evaluating the additionality of ecosystem services (e.g. flood protection as well as nature and landscape conservation). Where policy objectives overlap for a given river or lakeshore stretch (e.g. rehabilitation is realised as part of agricultural structural adjustment), no double funding should be allowed if the services provided are one and the same (e.g. land improvement should be financed as part of either agriculture policy or water policy), pursuant to the 1990 Act on Financial Aid and Compensation (Subsidies Act, Article 12).

Farmers providing space for waters are granted direct (compensatory) payments for preserving biodiversity on their lands under agricultural policy and pursuant to the WPA, Article 62b. This is justified insofar as farmers are getting paid for going beyond what cross-compliance requires them to do anyway (setting aside at least 7% of the farm for biodiversity promotion).

The proceeds of a tax on electricity bills support the legally required upgrading of hydropower plants to reduce their negative impact on watercourses. This concept of «electricity pays for electricity» does not appear to contradict the polluter-pays principle as hydropower plant operators are eligible for full compensation if limitation of their acquired rights of water power use entails excessive costs. Electricity consumers also subsidise hydropower development as part of energy policy. Differentiated FIT rates (which benefit plants with output of at least 1 MW) rightly provide an incentive to locate hydropower plants outside unmodified watercourses, but wrongly encourage siting on smaller rivers, the breeding ground for many fish, as FIT incentives increase as the size of the plant decreases.

About 25% of hydropower plants built prior to 1991 did not meet the 2012 deadline for implementing minimum flow requirements. As regards hydropower developments since 1991, Switzerland is to be commended for its consensus-building approach to setting «acceptable» minimum flows, which calls for weighing the economic and environmental interests involved. However, weighing of interests to set acceptable minimum flows balancing hydropower development and water-dependent ecosystems' protection has rarely been implemented in practice. One way to trigger weighing of interests would be to assess the significance of alluvial zones in protected areas and connection areas (the concept of ecological infrastructure) with a view to registering more alluvial zones in the Federal Inventory of Landscapes and Natural Monuments of National Importance. Another challenge is to revise long-standing rights of water use for power that impede rehabilitation of small rivers; these rights were often granted for an unlimited period.

Drinking water supply and groundwater protection

The WPA requires cantons to provide for general quantitative and qualitative protection of groundwater by subdividing their territory into groundwater protection zones and groundwater protection areas. The former are primarily intended to protect drinking water abstraction areas; the latter aim to protect groundwater for future use. Land use constraints on farming in groundwater protection zones may give rise to financial compensation based on income loss, under WPA Article 62a.

However, there are no national legal requirements to delimit groundwater protection zones or groundwater protection areas in cantonal master plans and land use plans. Few cantons have identified the necessary water resources for actual and future drinking water supply and included them in their master plans. In this respect, Switzerland could extend to

groundwater protection what is already being done regarding flood protection (since 1998) and space for surface waters (since 2011); both have to be incorporated in land use plans, including municipal land use plans when they are renewed.

Direct abstraction of groundwater is subject to taxation. The tax may be increased where recourse to public financial support has been necessary to protect groundwater. This is, in a way, the price to pay for the lack of groundwater protection in the past and the failure to take into account the protection of groundwater in today's cantonal land use planning. It is consistent with the beneficiary-pays principle, whereby those who benefit from groundwater protection should contribute to its cost. However, preferential tax rates for certain categories of users should be discontinued and the tax rate designed to reflect water scarcity.

Recommendations on water management

Urban sewage treatment and micro-pollutant removal

- Pursue efforts to upgrade urban sewage treatment plants with a view to reducing risks of water pollution by micro-pollutants; consider extending micro-pollutant abatement and control policy to industrial sewage.

Nutrient and pesticide management in agriculture

- Speed up release of the action plan for reduction of risks and sustainable use of phytosanitary products; in that context, consider phasing out the VAT concession on pesticides and phasing in pesticide taxation at production and wholesale points, based on toxicity.
- Consider introducing a tax on nitrogen surpluses at the farm level as a sanction for non-compliance with legal requirements under the WPA.

River system rehabilitation

- Consider the whole range of water-dependent ecosystems when selecting stretches of river and lakeshore for rehabilitation; in particular, foster the role of well-functioning river systems as connection areas within the ecological infrastructure concept called for by the Swiss Biodiversity Strategy.
- Consider revising long-standing rights of water use for power that impede rehabilitation of small rivers and designating selected river stretches as being of national importance, thereby triggering the weighing of interests between hydropower development and ecosystem rehabilitation for these river stretches.

- Ensure synergies and coherence between the different river rehabilitation objectives (e.g. in terms of hydrology, flood protection, protection of nature and landscape, farmland improvement); in particular, evaluate the additionality of ecosystem services and the overlap of policy objectives related to the rehabilitation of the Swiss river system.
- Extend water quality monitoring to small rivers and small lakes and improve understanding of their ecological functioning to develop protection measures, given their ecological importance and their high exposure to agricultural pollution.

Drinking water supply and groundwater protection

- Consider making the delimitation of groundwater protection areas and groundwater protection zones legally binding and having them fall within the framework of cantonal and municipal land use plans.

5. Biodiversity conservation and sustainable use of ecosystems

Status, trends and pressures

Switzerland has made progress in supporting biodiversity conservation and sustainable use of ecosystems over the past decade, with improved monitoring, development of a national biodiversity strategy, increased public spending and efforts to mainstream biodiversity into sectoral policies. However, despite an increase in forest cover (and status of forest habitats) as well as a slowing rate of decline of some species, the results so far are insufficient for significant improvement in the state of biodiversity.

There remain significant pressures on biodiversity from land use change, landscape fragmentation, pollution, interference with watercourses, habitat loss and disturbance, invasive species and climate change. The majority of inland water ecosystems are considered threatened, biodiversity-rich grasslands are being lost and the surface area of alluvial zones and wetlands decreased by 36% and 82%, respectively, between 1900 and 2010. In 2012, 36% of evaluated species were categorised as threatened, with 3% regionally extinct and 5% critically endangered (FOEN, 2014). Switzerland has one of the OECD's highest proportions of threatened species.

Room for improvement exists in monitoring and data collection. There is no publicly available national map of ecosystem distribution. Moreover, despite hosting the secretariat of the United Nations Environment Programme initiative The Economics of Ecosystems and

Biodiversity, Switzerland has not progressed significantly on developing its own monetary values for ecosystem services. Addressing these gaps could help build a stronger case for policy action.

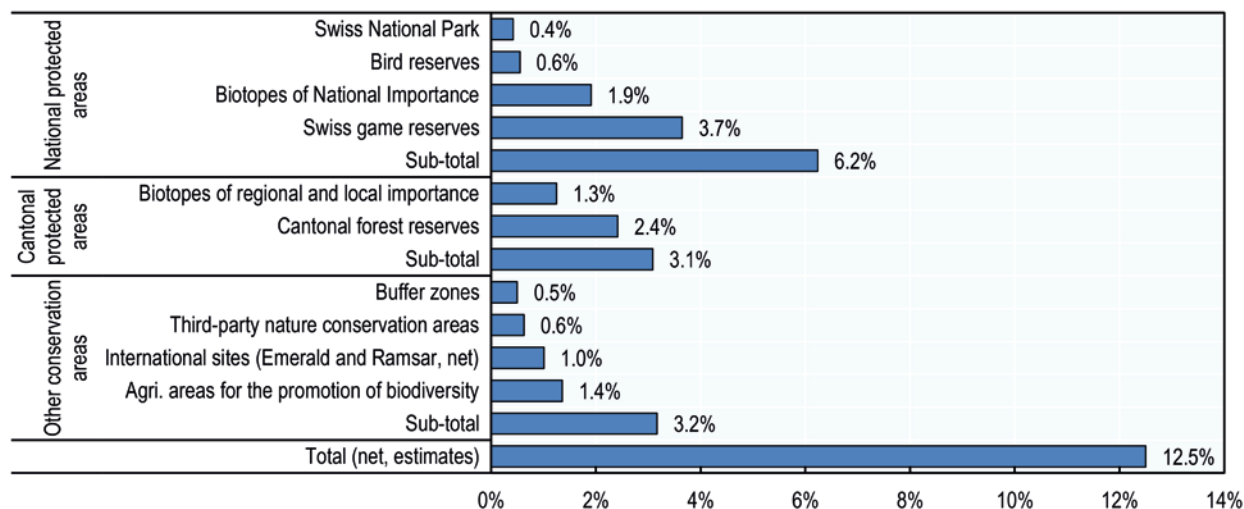
Institutional, legal and strategic framework

Switzerland features a very strong bottom-up decision-making system in which the cantons and municipalities have significant control, and important decisions such as national park designation are put to public referendum. This democratic system can greatly enhance synergies with local circumstances and interests, ensuring eventual local buy-in and support for implementation of agreed measures. However, it also presents a challenge for biodiversity protection in terms of the length of time required for consultation, prioritisation of the economic benefit and uneven implementation of national policies.

In September 2017, the Federal Council finally approved the action plan of the 2012 Swiss Biodiversity Strategy, more than three years past the government's commitment to do so (April 2014). An initial thorough consultation process, including with academia and civil society, had taken place in 2013, yet the Federal Council delayed the plan's publication, claiming further consultation with cantonal and communal authorities was necessary (FOEN, 2016c). It is too early to assess whether the measures, indicators and financial resources of the biodiversity action plan are sufficient to achieve the country's ambitious 2020 strategic goals.

Policy instruments for biodiversity conservation and sustainable use

Use of economic instruments has been limited. Switzerland relies mainly on regulatory instruments to meet biodiversity objectives. Protected areas at the national level have expanded over the past two decades, mainly through growth of the Biotopes of National Importance network and through cantonal and communal actions, but remain short of the global Aichi target to protect 17% of the earth's land surface by 2020. Only 6.2% of the land and inland waters enjoy national-level protection as defined by the International Union for Conservation of Nature management categorisation (Figure 4), though total protection across the country could prove to be as high as 12.5% once the government completes an inventory of additional protected areas at the cantonal and communal levels (FOEN, 2017a). Switzerland also has lower levels of strict protection than other OECD countries, relying heavily on a game reserve designation originally intended to limit excessive hunting. The quality of protected areas is also lacking: often they are too small, are poorly connected with each other and with European networks, and do not fully meet conservation objectives.

Figure 4. Designated areas for biodiversity have varying levels of protection

Note: Adjustments have been made to account for the estimated overlaps.

Source: FOEN (2017a), Biodiversity in Switzerland: Status and Trends.

In 1914, Switzerland was one of the first European countries to create a national park. Today, however, that park remains the only national park in Switzerland, which is unusual for an OECD country. The 2007 EPR recommended development of a park policy including creation of regional natural parks, peri-urban natural parks and a second national park. The rejection of a second national park in a November 2016 referendum, after 16 years of work with local authorities and conservation experts, was a major setback for park policy and for biodiversity conservation overall.

Landscape management policies hold the promise of helping address biodiversity challenges in a practical manner. The Swiss Landscape Concept, for example, integrates nature and landscape protection into all relevant sectoral policies (FOEN, 1998). Amendments to the Spatial Planning Act in 2013 that seek to reduce oversized development zones and better allocate existing reserves of development land are also positive. However, gaps in the project approval procedure and a fiscal system that encourages municipalities to allow urban sprawl limit progress (Waltert et al., 2010). Urban policy measures such as green space networks and corridors, potentially financed through taxes on residents and corporations, could help reduce habitat fragmentation and biodiversity loss in and around cities.

The federal government has increased efforts over the past decade and doubled the government share of expenditure related to biodiversity. However, financial resources remain insufficient to ensure the protection and restoration of important ecosystems and species. The

lack of resources may partly explain the failure to meet biodiversity targets. FOEN estimates that implementing measures needed to meet the Swiss Biodiversity Strategy objectives would lead to an annual funding gap of CHF 182 million to CHF 210 million to 2040 (CBD, 2017). In response, the Federal Council decided in May 2016 to invest CHF 135 million – an additional CHF 55 million plus CHF 80 million through repurposing from the FOEN budget – in urgent biodiversity measures over 2017-20. In September 2017 the Federal Council decided to extend urgent measures on biodiversity to 2023 and to dedicate CHF 180 million to them over the period 2021-23 – an additional CHF 160 million plus CHF 20 million reoriented from the FOEN budget. It was also decided to allocate CHF 50 million to support further measures to promote biodiversity in Switzerland in 2019-23. Financing of the biodiversity action plan was approved in a context of limited access to new sources of funds, at both the federal and cantonal levels, which may lead to an incremental implementation of the plan.

While Switzerland has not really used economic instruments for biodiversity, other than payments for biodiversity conservation in agriculture, there is significant potential for expansion of such instruments as a complement to enhanced protected areas and effective landscape management. Economic instruments can be a cost-effective way to address pressures on biodiversity, and a way to more appropriately reflect the value of ecosystem services, while offering an opportunity to raise revenue that can be used for additional conservation and restoration efforts. There is potential for taxing pesticides and agricultural nitrogen surpluses (Section 4), charging fees in forestry for the use of ecosystem services, imposing access fees in tourism and using development charges in cities to expand green space. Greater use of biodiversity offsets for infrastructure or tourism development might also be possible.

Switzerland should, moreover, make further progress in identifying and phasing out or reforming incentives harmful to biodiversity. Support for tourism infrastructure, for example, may be counter to some biodiversity objectives (Ecoplan, 2013).

There is also a need for more information measures, particularly given the use of referendums for major policy decisions. With polls showing that a majority of Swiss believe nature is doing well and the country is past the degradation stage and in a state of recovery (FOEN, 2017a; Schaub and Welte, 2017), access to information on the actual state of biodiversity and proactive awareness campaigns would be beneficial. Partnerships with non-government organisations (NGOs), industry associations and other stakeholders may be an effective way to improve awareness.

Mainstreaming biodiversity into economic sectors

Switzerland has generally done well at mainstreaming biodiversity considerations into sector-specific and other policies through the Swiss Biodiversity Strategy, Agricultural Policy packages, Forest Policy 2020 and Energy Strategy 2050, as well as other approaches. However, the strategies have yielded limited tangible results, implying greater effort is needed to translate general

declarations of intent into concrete measures and ensure effective and consistent implementation across cantons.

The Confederation commendably reformed its agricultural support policies to encourage biodiversity conservation and sustainable use (Section 3), and requires farmers to designate at least 7% of agricultural land as biodiversity promotion areas, as part of environmental cross-compliance criteria, to be eligible for direct payments. However, the joint FOEN/FOAG review of compliance with 2008 agri-environmental targets found that the agriculture sector had not attained the majority of objectives relevant to biodiversity, particularly in terms of habitat quality and connectivity (FOEN/FOAG, 2016). Further effort could be made to ensure that biodiversity promotion areas are selected based on ecological criteria. Pollution from pesticides and fertilisers used in agriculture also continues to pose a significant threat to inland water sources (Section 4) as well as soil fertility and non-target organisms, and agriculture is responsible for 92% of the country's ammonia emissions, which contribute to significant adverse effects on forests, wetlands and grasslands (ES, 2015).

The forestry and energy strategies include links to biodiversity conservation and sustainable use, but effective implementation depends on agreements with the cantons, energy providers and forest owners as well as adequate financing, and there is potential for conflict with other goals, such as increasing wood harvesting rates and expanding hydropower and wind energy, which needs to be carefully managed. Switzerland has among the lowest levels of forest reserves in Europe, with only 5.6% of forest surface dedicated for the purpose (FAO and EFI, 2015). A commitment to protect 8% by 2020 and 10% by 2030, and a requirement for near-natural silviculture, exists alongside a policy to increase wood harvesting rates (FOEN, 2017a). Introducing a system of fees and payments for ecosystem services, paid by forest users and linked to forests' ecological value, would help protect valuable forest ecosystems while raising revenue for conservation. For energy, new hydropower and wind projects will need to be carefully implemented to minimise their impact on terrestrial and aquatic ecosystems and species such as fish and birds. The 2011 WPA amendments requiring hydropower plant operators to reduce their negative impact on watercourses (hydropeaking, changes in sediment transport, obstacles to fish migration) by 2030 are encouraging.

Expansion of tourism and transport infrastructure also presents a significant challenge for biodiversity in the form of increased landscape fragmentation and habitat disturbance. More emphasis will be needed on creative mitigation measures like those pursued in other countries, such as well-functioning wildlife corridors and wildlife refuges adjacent to ski resorts, as well as expanded use of economic instruments such as fees for tourism operations. It is ultimately in the tourism industry's interest for landscape services to be maintained – hence the case for consumers of landscape services to pay for their maintenance. There have been few specific and targeted actions to address strategic commitments to integrate biodiversity into tourism and transport policy, though the recently launched biodiversity action plan may introduce more meaningful measures and help improve vertical co-ordination and co-operation.

Recommendations on biodiversity conservation and sustainable use

Status, trends and pressures on biodiversity

- Create a national ecosystem map that identifies priorities for action in terms of protection, pressures and corridors, considering threatened ecosystems and species, as a basis for establishing a more formal and legally binding tool for spatial planning.

Institutional, legal and strategic framework

- Move forward with implementation of the action plan for the Swiss Biodiversity Strategy, pursuing measures with quantified objectives, clear indicators to measure progress and adequate human and financial resources for implementation.
- Work with NGOs, the private sector and education systems to raise biodiversity awareness, engage further with local communities through dialogue on sustainable local development, and develop tools and guidelines for reporting their impact and contributions to biodiversity conservation.

Instruments for biodiversity conservation and sustainable use

- Develop policies, programmes and action plans to meet Switzerland's commitment to protect at least 17% of its territory by 2020, and increase the volume and quality of ecosystem and species protection, by expanding protected areas and other area-based conservation measures to address gaps and improve connectivity within Switzerland and with neighbouring countries; for instance, the Emerald Network should be expanded and coordination with Natura 2000 strengthened.
- Increase federal, cantonal and communal funding consistent with the Swiss Biodiversity Strategy and action plan, either through larger public appropriations or by finding alternative sources of revenue, such as economic instruments, which could include taxes on pesticide use and farm nitrogen surpluses and charges for use of ecosystem services; the complete system of agricultural direct payments should be focused so as to holistically optimise biodiversity-related incentives.
- Dedicate resources towards identifying and phasing out subsidies and tax incentives with harmful effects on biodiversity, and redirect tax instruments towards behaviour favouring the conservation and sustainable use of biodiversity, including for landscape management, where incentives within the fiscal system encourage urban sprawl.

Mainstreaming biodiversity into economic sectors

- Pursue efforts to strengthen the potential of the agricultural sector to support biodiversity by selecting biodiversity promotion areas based on environmental objectives (e.g. ecological infrastructure) rather than agricultural objectives.
- Ensure that forestry policy is consistent with biodiversity objectives, and with the national goal of protecting 8% of forest area by 2020 and 10% by 2030; explore opportunities to use economic instruments for forest conservation, such as fees and payments for ecosystem services paid by forest users, while promoting increased private certification.
- Pursue measures to mitigate the impact of tourism and transport infrastructure on biodiversity, such as improving wildlife corridors, introducing fees for tourism operators and developing biodiversity refuges adjacent to ski resorts.

References

- CBD (2017), Financial Reporting Framework Clearing-House Mechanism (database), Secretariat of the Convention on Biological Diversity, Montreal, hchm.cbd.int/database/record/30F64DF1-7937-75AD-24D0-AE53B6FADD46 (accessed May 2017).
- CCE (2016), Conférence des chefs des services de la protection de l'environnement website, www.kvu.ch/fr/home (accessed 10 October 2016).
- Ecoplan (2013), Finanzielle Anreize bezüglich Biodiversität optimieren, Economic Research and Policy Consultancy, Bern.
- Education21 (2016), Education for Sustainable Development website, www.education21.ch/en/education21/portrait (accessed 27 October 2016).
- ES (2015), Rapport du Conseil fédéral, Environnement Suisse, www.bafu.admin.ch/dokumentation/15710/15711/index.html?lang=fr.
- Eurostat (2016), Material Flow Accounts (database), Eurostat, Luxembourg, http://ec.europa.eu/eurostat/web/products-datasets/-/env_ac_rme.
- Federal Council (2016), Efficacité des aides financières accordées pour la réduction des émissions de CO₂ des bâtiments conformément à l'art. 34 de la loi sur le CO₂ : Rapport du Conseil fédéral à l'Assemblée fédérale, www.bafu.admin.ch/dam/bafu/fr/dokumente/klima/fachinfo-daten/wirksamkeit_der_finanzhilfenzurverminderungderco2-emissionenbeig.pdf.download.pdf/efficacite_des_aidesfinancieresaccordeespourlareductiondesemissi.pdf.
- Federal Council (2015), Environment Switzerland 2015, BBL, Publications distribution office, Bern.
- FOEN (2017a), Biodiversity in Switzerland: Status and Trends – Results of the Biodiversity Monitoring System in 2016, State of the Environment N° 1630, Federal Office for the Environment, Bern.
- FOEN (2017b), « Pour une meilleure qualité de l'eau », Magazine « environnement », 1/2017.
- FOEN (2016a), Evaluation environnementale stratégique [Strategic Environmental Assessment], www.bafu.admin.ch/bafu/fr/home/themes/eie/evaluation-environnementale-strategique--

[ees-.html](#) (accessed 26 February 2017).

FOEN (2016b), Switzerland Second Biennial Report under the UNFCCC, http://unfccc.int/national_reports/biennial_reports_and_iar/submitted_biennial_reports/items/7550.php.

FOEN (2016c), Stratégie et plan d'action pour la biodiversité, www.bafu.admin.ch/bafu/fr/home/themes/biodiversite/info-specialistes/mesures-de-conservation-de-la-biodiversite/strategie-et-plan-daction-pour-la-biodiversite.html.

FOEN (2014), Switzerland's Fifth National Report under the Convention on Biological Diversity, www.cbd.int/doc/world/ch/ch-nr-05-en.pdf.

FOEN (2013a), Strengthen Environmental Enforcement, www.bafu.admin.ch/bafu/en/home/topics/law/enforcement-and-supervision/enforcement.html (accessed 16 January 2017).

FOEN (2013b), Report to the Federal Council: Green Economy – Report and Action Plan, www.bafu.admin.ch/dam/bafu/en/dokumente/wirtschaft-konsum/fachinfo-daten/gruene_wirtschaftberichterstattungundaktionsplan.pdf.download.pdf/green_economy_reportandactionplan.pdf.

FOEN (1998), Swiss Landscape Concept, www.sib.admin.ch/fileadmin/migrated/content_uploads/VU-8004-F_2010_01.pdf.

FOEN and FOAG (2016), « Objectifs environnementaux pour l'agriculture : Rapport d'état 2016 », Connaissance de l'environnement, 1633, Federal Office for the Environment and Federal Office for Agriculture, Bern.

FOT (2016), «Modal Shift: Current Status», presentation to the OECD, Federal Office of Transport, Bern.

Fondation RPC (2016), Rapport annuel 2015, www.stiftung-kev.ch/fileadmin/media/kev/kev_download/fr/Geschaeftsbericht_2015_fr.pdf.

FAO and EFI (2015), State of Europe's Forests 2015, Ministerial Conference on the Protection of Forests in Europe, Madrid, Food and Agriculture Organization of the United Nations and European Forest Institute, www.foresteuropa.org/docs/fullsoef2015.pdf.

Frischknecht, R. et al. (2014), Development of Switzerland's Worldwide Environmental Impact, www.bafu.admin.ch/dam/bafu/en/dokumente/wirtschaft-konsum/uw-umwelt-wissen/entwicklung_der_weltweitenumweltauswirkungenderschweiz.1.pdf.download.pdf/development_of_switzerlandsworldwideenvironmentalimpactextendeds.pdf.

- FSO (2016), Enquête Omnibus 2015 : Qualité de l'environnement et comportements environnementaux, Federal Statistical Office, Neuchâtel, www.bfs.admin.ch/bfsstatic/dam/assets/415326/master.
- Gälli, R. et al. (2009), Micropolluants dans les eaux : Évaluation et réduction de la charge polluante des eaux usées urbaines, Connaissance de l'environnement N° 0917, Federal Office for the Environment, Bern.
- IEA (2017a), CO₂ Emissions from Fuel Combustion Statistics (database), IEA/OECD Publishing, Paris, www.iea.org/statistics/relateddatabases/co2emissionsfromfuelcombustion/.
- IEA (2017b), IEA World Energy Statistics and Balances (database), IEA/OECD Publishing, Paris, www.iea.org/statistics/relateddatabases/worldenergystatisticsandbalances/.
- Mazur, E. (2011), «Environmental Enforcement in Decentralised Governance Systems: Toward a Nationwide Level Playing Field», OECD Environment Working Papers, No. 34, OECD Publishing, Paris, <http://dx.doi.org/10.1787/5kgb1m60qtq6-en>.
- OECD (2017a), Economic Policy Reforms 2017: Going for Growth, OECD Publishing, Paris, <http://dx.doi.org/10.1787/growth-2017-en>.
- OECD (2017b), OECD Environment Statistics (database), <http://dx.doi.org/10.1787/env-data-en> (accessed 16 February 2017).
- OECD (2017c), OECD Database on Policy Instruments for the Environment, <http://www2.oecd.org/ecoinst/queries/> (accessed 11 April 2017).
- OECD (2017d), Green Growth Indicators 2017, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264268586-en>.
- OECD (2017f), OECD Environment Statistics (database), http://stats.oecd.org/Index.aspx?DataSetCode=PAT_IND (accessed 8 March 2017).
- OECD (2016), OECD National Accounts Statistics (database), <http://dx.doi.org/10.1787/na-data-en> (accessed 23 March 2017).
- OECD (2015a), Going Green: Best Practices for Sustainable Public Procurement, OECD Publishing, Paris, www.oecd.org/gov/ethics/Going_Green_Best_Practices_for_Sustainable_Procurement.pdf.
- OECD (2015b), OECD Companion to the Inventory of Support Measures for Fossil Fuels 2015, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264239616-en>.

- OECD (2015c), *Climate Change Mitigation: Policies and Progress*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264238787-en>.
- OECD (2014), *OECD Science, Technology and Industry Outlook 2014*, OECD Publishing, Paris, http://dx.doi.org/10.1787/sti_outlook-2014-en.
- OECD (2013), *Inventory of Estimated Budgetary Support and Tax Expenditures for Fossil Fuels 2013*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264187610-en>.
- OECD (2007), *OECD Environmental Performance Reviews: Switzerland 2007*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264030541-en>.
- Petitpierre, A. (2015), *Environmental Law in Switzerland*, Kluwer Law International, Alphen aan den Rijn, the Netherlands.
- Roy R. and N-A. Braathen (2017), «The Rising Cost of Ambient Air Pollution in the 21st Century: Results for the BRIICS and the OECD Countries», paper prepared for the OECD Working Party on Integrating Environmental and Economic Policies, ENV/EPOC/WPIEEP(2016)24/REV1.
- Schaub, A. and S. Welte (2017), *UNIVOX Umwelt 2016*, gfs-zürich, <http://gfs-zh.ch/wp-content/uploads/2017/03/Univox-Umweltbericht-2016.pdf>.
- SECO (2016), «Analyse d'impact de la réglementation», State Secretariat for Economic Affairs, www.seco.admin.ch/seco/fr/home/wirtschaftslage---wirtschaftspolitik/wirtschaftspolitik/regulierung/regulierungsfolgenabschaetzung.html (accessed 10 October 2016).
- Smith, S. (2014), «Innovative Economic Instruments For Sustainable Materials Management», paper prepared for the OECD Working Party on Resource Productivity and Waste, ENV/EPOC/WPRPW(2014)8.
- South Pole Group (2015), *Carbon Risks for the Swiss Financial Centre: Summary*, <http://www.thesouthpolegroup.com/news/new-study-unveils-the-carbon-risks-for-the-swiss-financial-center> www.thesouthpolegroup.com/news/new-study-unveils-the-carbon-risks-for-the-swiss-financial-center.
- Swiss Confederation (2016), *Grüne Wirtschaft – Massnahmen des Bundes für eine ressourcenschonende, zukunftsfähige Schweiz* («The Green Economy – Federal Measures for a Resource-Conserving and Future-Proof Switzerland») Report to the Federal Council, Swiss Confederation, Bern, www.bafu.admin.ch/dam/bafu/en/dokumente/wirtschaft-konsum/fachinfo-daten/bericht_an_den_bundesratgruenewirtschaft.pdf.download.pdf/bericht_an_den_bundesratgruenewirtschaft.pdf.

Swiss Sustainable Finance (2016), Swiss Sustainable Investment Market Report 2016, www.sustainablefinance.ch/en/swiss-sustainable-investment-market-report-2016-content---1--3044.html.

Waltert, F. et al. (2010), Fiskalische Instrumente und Flächeninanspruchnahme, Swiss Federal Institute for Forest, Snow and Landscape Research (WSL), FOEN, Federal Office for Spatial Development, Bern, <https://biblio.parlament.ch/e-docs/353580.pdf>.

Watkins, E. et al. (2012), «Use of Economic Instruments and Waste Management Performances», paper prepared for the European Commission (DG ENV), Unit G.4 Sustainable Production and Consumption, 10 April 2012, Ref. ENV.G.4/FRA/2008/0112, http://ec.europa.eu/environment/waste/pdf/final_report_10042012.pdf.

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SWITZERLAND

(abridged version)

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Switzerland has taken steps to improve the environmental performance of its agricultural, energy and transport sectors. The country is a top OECD performer in terms of greenhouse gas emissions intensity and it should be commended for its innovative approach towards rehabilitation of its river system. Yet unsustainable consumption patterns and high levels of municipal waste generation, as well as high percentages of threatened species, are areas of concern. As a major financial centre, Switzerland has a key role to play in promoting green finance.

This is the third Environmental Performance Review of Switzerland. It evaluates progress towards sustainable development and green growth, **with special features on water management and biodiversity conservation and sustainable use.**