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FÜRSTENTUM LIECHTENSTEIN

5th National Report on the Implementation of the Convention on Biological Diversity in the Principality of Liechtenstein

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Credits

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Titelbild: Eurasian bittern in nature protection area „Gampriner Seelein“ (© Rainer Kühnis)

Content

Summary

The evaluation of the status of biological diversity and its sustainable use in Liechtenstein does not paint a uniform picture. On one hand, there are factors leading to the loss of habitats, such as the sprawl of built-up areas; on the other hand, efforts to protect and restore habitats have been intensified since 1990. Despite measures taken in various areas, Liechtenstein will not succeed overall in achieving the 2020 targets of the National Biodiversity Strategy as well as those of the Convention on Biological Diversity (CBD). Some of the subordinate goals have already been accomplished or will be achieved until 2020, however.

Status, trends and threats

There has been a decline regarding the total size of legally protected forest areas (special forest areas and forest reserves). Due to shortfalls in certain storing capacities some land fill compounds were extended. Therefore some of the legally protected forest areas had to be reclassified. A positive picture can be drawn with regard to the situation of nature and landscape protection areas where a respective increase took place. For the first time in 30 years two new nature protected areas were established. Another success is the designation of the first legally protected landscape protection area. Around 12.3% of the total territory currently enjoys a protective legal status. The sites of rough pastures as well as the newly defined quiet zones for wild animals were not considered. Their legal status is currently under review. That review will also affect the total size of protected areas. However, the trends in the number of species present in Liechtenstein and the number of species listed on the Red Lists are slightly worrying. The amount of different fish species remained constant and the number of endangered fish species even declined from 71% to 62%. But the numbers of endangered species are still much higher than in the neighbouring countries. The situation aggravated for amphibians where one species disappeared completely. For mammals, Liechtenstein does not maintain a specific Red List and with respect to other animal and plant species no relevant changes were observed since the last CBD Report in 2009.

Forests constitute the largest habitats in Liechtenstein and even expand.. The National Forest Inventory 2010 indicated that the forest area has grown since the last inventory in 1998. In addition, the share of dead woods as well as the share of hard woods within the forests increased which lead to an improved mixture of woods and generally raised the biological value of the forest. Problems remain, however, with respect to forest regeneration, in particular due to damages caused by wild animals. A further challenge is the spreading of invasive neophytes and the ashdieback.

The total area of farmland in Liechtenstein declined. The decrease of farmland is primarily caused by the extension of settlement areas and transport infrastructures as well as by revitalisations of stream waters. No new observations since the last CBD Report were made with regard to alpine agriculture and the conservation of genetic diversity within the agricultural sector.

The development of waters in Liechtenstein shows a mixed picture. On one hand there has been a slight improvement regarding macrozoobenthos; the chemical water quality remains on a high level and several revitalisations have been made since 2009. On the other hand there is a worrying ecomorphological development of valley waters. The loss in habitats is reflected in the number of species listed in the Red Lists of water plants and fish, currently 61% or 62%, respectively of all species occurring in Liechtenstein.

Also very negative is the assessment of the situation in the Alpine Rhine where almost no more habitats for fish are provided. This conclusion is supported by the fishery statistics and by a comprehensive survey on the ecological fish stock from 2013. This situation is caused by the impacts of narrowed river beds as well as from massive downsurge and upsurge activities in the Rhine.

National Biodiversity Strategy and National Action Plan 2020

Based on the information gathered within the preparation of the 4th CBD Report, Liechtenstein has developed a National Biodiversity Strategy. During 2009 and 2010, representatives of the Government and NGOs held several workshops on that topic. The workshops led to the conclusion of a strategy until 2020 in order to conserve and to ensure a sustainable use of biodiversity in Liechtenstein. The strategy is based on one overall target, four sub-targets and 12 strategy elements. Concrete measures were defined for all 12 strategy elements in order to achieve the strategy goals. 40 measures have been identified of which some have already been implemented or will be implemented by 2020.

Progress towards the goals of the CBD

Parties adopted a new Strategic Plan for Biodiversity for the 2011 to 2020 period at the 10th Conference of the CBD Parties (COP-10, Aichi-Nagoya, Japan, held in October 2010). The Strategic Plan lays out a vision together with a respective mission. It is supported by five strategic targets including 20 subtargets. These subtargets are called “Aichi Targets”. The Strategic Plan serves as a flexible framework for national and regional policies. It aims at the comprehensive implementation of the three core targets of the CBD.

Until today, Liechtenstein has achieved two out of the 20 Aichi Targets. Eight targets will be achieved within the given timeframe from 2015 to 2020. One target does not apply to Liechtenstein as a landlocked country. The remaining four targets will most likely not be achieved by Liechtenstein.

The outcome of this assessment is worrying. The remaining four targets address important areas such as reducing the country’s ecological footprint on its biodiversity, reducing the losses of natural habitats, the conservation of endangered species and the mobilisation of financial means.

A more positive picture can be drawn with respect to the achievement of the Millennium Development Goals of the CBD. Goal 8 obliges developed countries to use their economic powers to achieve equality among all countries in the world. In this context goal 8 requires Liechtenstein to provide the respective development assistance. To compare ODA among states, an indicator is commonly used to measure ODA as a percentage of gross national income (GNI) of a given state. The international ODA target is 0.7%. The Liechtenstein Government has repeatedly underscored its commitment to achieving this target as soon as possible. The currently available ODA percentage for 2011 is 0.69 %.

1 Biodiversity status, trends, and threats and implications for human well-being

1.1 Introduction

Liechtenstein is situated between 47° 02’ and 47° 16’ north and between 9° 28’ and 9° 38’ east. This corresponds approximately to the centre of the 1,200 km long Alpine range (Fig. 1). The country is embedded between Switzerland and Austria. Natural boundaries are the Alpine Rhine to the west and the

Rätikon massif to the east. Covering 160 km^2, Liechtenstein is the fourth-smallest sovereign state in Europe.

Structure of physical regions and diversity of species

Liechtenstein is structured into three physical regions with special characteristics in regard to geology, climate, exposure, and exploitation: the Rhine Valley plain, the Rhine Valley slopes, and the mountain region (Fig. 1, Fig. 2). The Rhine Valley plain in the west covers about one third of the country's territory. It includes agricultural areas and settlements, i.e. intensively used landscapes. The Rhine Valley slopes with their steep forested mountain slopes and isolated settled terraces adjoin the Rhine Valley plain. They cover another third of the national territory. The final third is the mountainous area behind the Rhine Valley watershed with its Alpine high valleys.

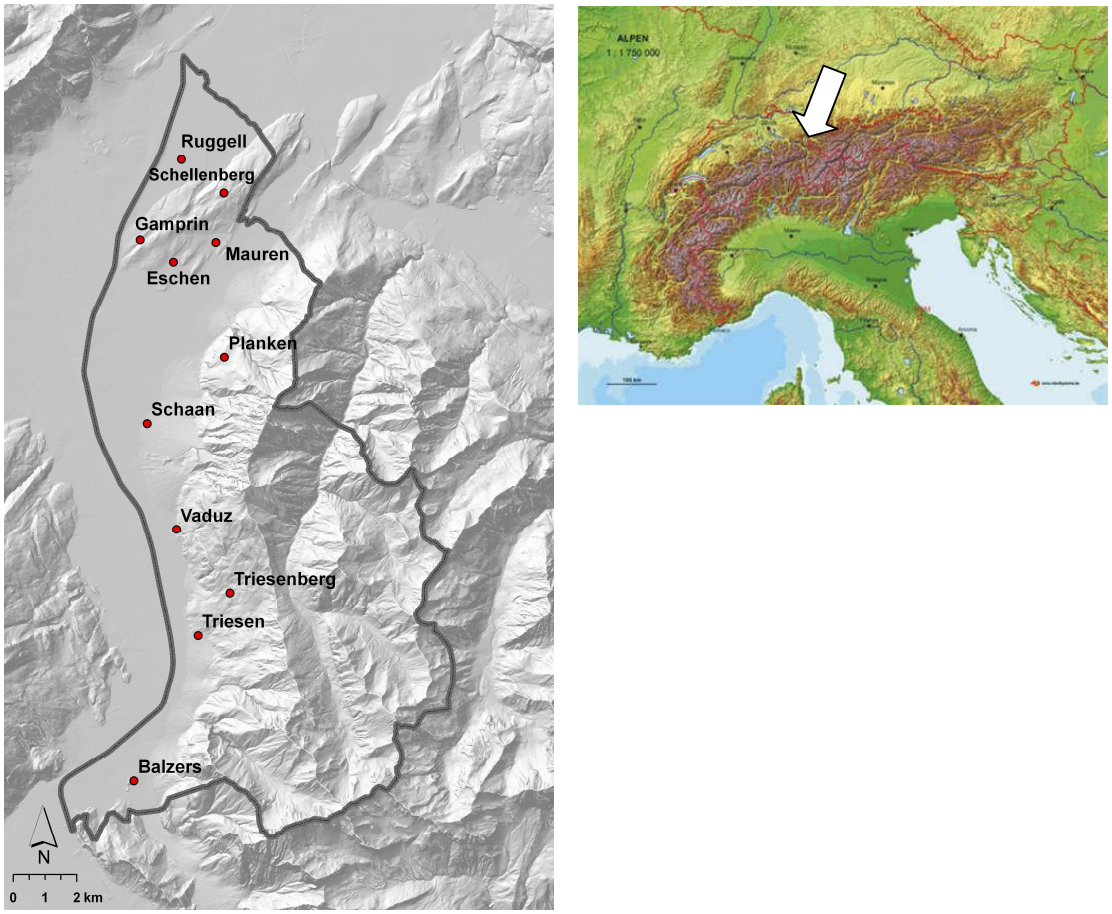


Fig. 1. The Principality of Liechtenstein (left) and its location in the Alpine range (top right)
(Left figure: H. Schmuck, Data: AWNL; right figure: www.freytagberndt.de [1]).

[1] Freytag-Berndt GmbH: http://www.freytagberndt.de/images/shop/big/LEN_ALP.JPG, 15. Oktober 2009

Abb. 2. The physical regions of Liechtenstein: Rhine Valley plain and forested Rhine Valley slopes (left image), mountain region (right image) (Photographs: E. Ritter)

In particular, the relief contributes to the diversity of the landscapes. An altitudinal gradient between 450 and 2,600 meters above sea level from west to east characterizes the landscape. Plant communities occur at all altitudinal levels between colline and alpine altitudinal zones. Liechtenstein is located at the transition between the Eastern Alps and the Western Alps, which have a different geological background. Climatically, the country is in the transition zone between the oceanic and continental climates, with about 1,000 mm of precipitation each year in Vaduz. [2] These factors are responsible for the great diversity of flora and fauna.

Liechtenstein does not yet have a comprehensive biodiversity monitoring programme. Therefore, the analyses base on indicators of the individual topics. The report is structured according to the main habitat types of Liechtenstein (forest, farmland, waters and mountains).

The report is based on the relevant legal texts, inventories, opinions, reports on performance reviews and research results. But also documentation on concepts and strategies in the various specialized areas has been taken into account.

[2] Office of Statistics (2014), Statistical Yearbook of Liechtenstein 2014

1.2 General indicators

At the end of 2012, Liechtenstein had a population of approximately 37,000. The population density was about 230 per km^2. The area of the country is 160 km^2, of which 41% are forests, 33% agricultural and Alp areas, 11% settlement areas, and 15% non-productive land.[3] Excluding forests, non-productive areas, and alp pastures, about 52 km^2 are inhabitable. This increases the effective population density to about 710 per km^2. The population of Liechtenstein has more than doubled since 1960 (Fig. 3). The size of settlement areas has grown accordingly (Fig. 4).

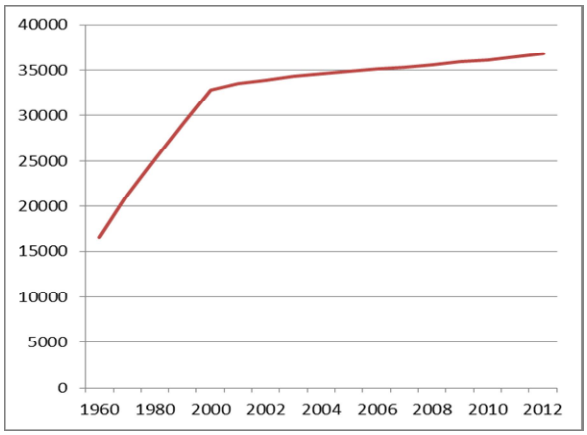


Fig. 3. Population development in Liechtenstein since 1960[4]

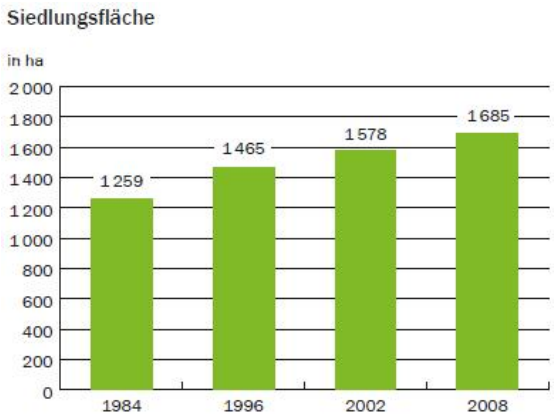


Fig. 4. Development of settlement areas since 1984[5]

The landscape development differs heavily in the three physical regions of the Rhine Valley plain, the Rhine Valley slopes, and the mountain area. Especially the topographically and climatically favoured Rhine Valley plain changed considerably since the Second World War. The change mainly concerns the intensified and mechanized agriculture, sprawling construction for settlements and transport infrastructure, and regulation and flood control structures and drainage of agricultural areas. This development has also included the lower altitudes of the Rhine Valley slopes. The higher altitudes and the mountain region have largely been spared from intensification, however. In those areas, threats to biological diversity seem to origin in the abandonment of land use, resulting in the fallowing of marginal yield areas. In this respect, extensive agriculture heavily contributes to the conservation of biodiversity. With the segregation of use – intensification on the one hand and abandonment of use on the other – the situation in Liechtenstein is comparable to other regions in the Alps.

[3] Office of Statistics (2014), Areal Statistics of the Principality of Liechtenstein 2008

[4] Office of Statistics (2014), Population statistics 2012

[5] Office of Statistics (2014), Environmental Statistics 2012

1.3 Nature and Landscape

Liechtenstein's landscape presents itself as a cultural landscape influenced by human beings for centuries. This is typical for the densely settled Alpine regions. The responsibility of nature and landscape protection today is not only to conserve the remaining natural landscapes, but also the cultural landscapes rich in structure and species. The protection of biological diversity, natural landscapes, and traditional cultural landscapes as well as the promotion of sustainable development are a horizontal task.

A healthy nature and landscape does not only serve as natural habitat for flora and fauna but also states a recreation area for human beings. This so called soft factor plays an important role for Liechtenstein's attractiveness for people as a place to work and live. A healthy nature and landscape is therefore also often considered as an advantageous location factor and is promoted accordingly.

Status und Trend

Protection Areas

There are four categories of legally protected areas in Liechtenstein: nature protection areas, forest- and landscape protection areas, the plant protection area, and landscape protection areas (Table 1). Nature and forest protection areas are the two most strictly protected categories, with a focus on the conservation of habitats for threatened animal and plant species. They are protected by law or ordinance and include the goals of conservation and development. They cover an area of 1'988 ha, which corresponds to 12,3 % of Liechtenstein's territory.

The eleven nature protection areas are largely wetlands and are situated in the Rhine Valley. They serve to protect swamps and waters. The largest nature protection area, the Ruggeller Riet (93 ha), is the most significant bird breeding area in Liechtenstein and is a wetland of international importance (Ramsar wetland no. 529, 06/08/1991).

The 30 forest protection areas, which include forest reserves and special forest areas (Chapter 1.4) are mainly located at higher elevations as well as along the river Rhine (remainders of former alluvial forests).

The Liechtenstein mountain area is a contiguous plant protection area intended to help preserve mountain flora and the appearance of the landscape. The protection provisions are less stringent than in the nature and forest protection areas. In addition, 28 landscape protection areas are included in the Inventory of Nature Priority Areas.[6] However, only a part of these areas enjoy a respective protection by ordinance. The inventoried landscapes are of exceptional importance due to their natural scenery or their cultural-historic value. The inventory serves as an instruction framework. It must be taken into account by the state and the municipalities, especially when it comes to land use planning (Tab. 1).

[6] Broggi et al. (1992). Inventory of Nature Priority Areas

Table 1. Categories of protection areas in Liechtenstein

Designation	Type of protetion	Year of establishment	Area [ha] (2009)	Share of national territory [%] (changes since 2009)
Nature protection areas	Legal [7]	1961 - 1978, 2012 - 2013	176 (166)	1.0 (± 0)
Forest protection areas	Legal[8] [9]	2000	1'748 (1'879)	10.8 (- 0.9)
Plant protection areas	Legal[10]	1989	6'247 (6'246)	39.0 (± 0)
Landscape protection areas	Legal[11]	2013	64 (0)	0.4 (+ 0.4)
Landscape protection areas (Inv.)	Inventory with instructions for authorities	1998	1'556 (1'556)	9.7 (± 0)

Nine out of eleven nature protection areas were established in the 1960s and 1970s. In the years 2012 and 2013 two more nature protection areas were established after a period of 30 years. The Inventory of Nature Priority Areas still includes various small-scale biotopes that should be placed under protection. There is no additional need for action with respect to the designation of forest protection areas. The forest areas included in the Inventory of Nature Priority Areas were almost all placed under protection by ordinance in 2000. The ordinance had been amended several times in order to allow for the extension of landfill areas.

Rough Pastures

Conservation of animal and plant species in Liechtenstein is not possible with the designation of protection areas alone. Accordingly, measures are also undertaken outside the protection areas to conserve habitats for animals and plants. The inventory of rough pastures covers wet bedding meadows, moors, and dry meadows. The most important locations, other than the wet meadows, are the species-rich, dry, rough pastures. These are traditionally extensively-used, late-mown pastures on steep slopes. Nowadays, cultivation agreements are concluded on the basis of the Law on the Protection of Nature and Landscape. In 2013 the first countrywide mapping of all rough pastures locations was finalized and published afterwards. A comparison with the respective inventory from 1990 lead to promising results: almost all wet rough pasture locations have been conserved. With respect to the dry rough pasture location the huge majority of the areas were also conserved. This is remarkable since the ecological criteria applied in 2013 were far more stringent than the ones applied in 1990.

[7] Gesetz zum Schutz von Natur und Landschaft (NSchG), LGBl. 1996 Nr. 117

[8] Waldgesetz (WaldG), LGBl. 1991 Nr. 42

[9] Verordnung über Waldreservate und Sonderwaldflächen, LGBl. 2000 Nr. 230

[10] Verordnung zum Schutz der Gebirgsflora, LGBl. 1989 Nr. 49

[11] Verordnung über das Landschaftsschutzgebiet „Periol, Bofel, Neufeld, Undera Forst" in der Gemeinde Triesen, LGBl. 2013 Nr. 311

Species and habitat development

Liechtenstein has a species-rich fauna and flora (Tab 2.). The richness in species is due to its location in the Alpine Rhine Valley. The valley is a border region in terms of geology, geobotany, and zoogeography. This is where the Eastern and Western Alps meet and the range of Eastern Alpine and Western Alpine flora and fauna overlap. Liechtenstein maintains its own Red Lists corresponding to the IUCN criteria and taking account of the particular small-scale circumstances. Despite the legal foundations, which have existed for decades and have repeatedly been adjusted, certain groups of species are threatened, some acutely: 25% of plants, 40% of birds, 62% of fishes, 67% of reptiles, and 75% of amphibians are included in the various categories of the Red List. Since the last National CBD Report in 2009 new studies on "mammals", "amphibians" and "fishes" have been performed. Liechtenstein has no Red List for mammals. The level of threat decreased from 71% to 62% among the local fish species. An increase of the level of threat has been observed for the species of amphibians where today ¾ of all local species have been put on the Red List. In 2009 it was "only" 2/3 of all a local amphibian species.

Table 2. Species numbers of selected plant and animal groups in Liechtenstein. For purposes of comparison, the corresponding species numbers in Switzerland are also provided.

Species Group	Country	Species	Source
Plants	Liechtenstein	1'500	Waldburger et al. (2003)
	Switzerland	2'700	Landolt (1991)
Mammals	Liechtenstein	41	Broggi et al. (2011)
	Switzerland	59	BDM (as of 2012)[12]
Bats	Liechtenstein	20	Broggi et al. (2011)[13]
	Switzerland	30	
Breeding Birds	Liechtenstein	134	Willi (2006)
	Switzerland	178	BDM (as of 2012)
Reptiles	Liechtenstein	7	Kühnis (2006)
	Switzerland	15	BDM (as of 2012)
Amphibians	Liechtenstein	9	Kühnis (2011)
	Switzerland	18	BDM (as of 2012)
Fishes	Liechtenstein	26	Bohl et al. (2014)
	Switzerland	86	BDM (as of 2012)

Threats and losses

The greatest threat to Liechtenstein's nature and landscape is the destruction of natural habitats and the increase in settlement areas and infrastructure. But also the increasingly intensive use of the landscape for recreation and leisure is a threat. Consequences include the loss, dissection and fragmentation of suitable habitats. These developments may lead to a growing isolation of certain populations and a respective genetic depletion. This may cause the disappearance of species in Liechtenstein. Another major threat to Liechtenstein's biodiversity are the alienflora and fauna species, the so called neobiota.

[12] Biodiversity Monitoring Switzerland: Knowledge, Species numbers, www.biodiversitymonitoring.ch, Status July 2014

[13] http://www.fledermausschutz.ch/Fledermaeuse/Artliste.html - Stand Juli 2014

Up to today around 100 alien plant species have been recorded in Liechtenstein.[14] About one forth of these species show invasive tendencies, i.e. spread uncontrollably.[15]

Due to the fast aggrandisement of these invasive species, local species are under pressure and are increasingly threatened to be finally eliminated from their natural habitat. An increasing amount of invasive species can be observed especially within nature protection areas. Many of the local threatened species may be found there. Therefore invasive species present an acute danger for many of the local species of Liechtenstein. Furthermore, it has been realized that certain changes in nature protection areas and in other ecological valuable areas are taking place. This could lead to a deterioration of quality to certain species. For instance, vegetation surveys in the largest nature protection area in Liechtenstein, the Ruggeller Riet wetland, show desiccation tendencies and an increase in eutrophication. This especially threatens rough pasture communities.[16]

In summary, the described threats may not only lead to the disappearance of species but in the long-term may cause the instability and the distinction of whole ecosystems. This development may at the end lead to negative consequences for human beings. Certain services and functions of ecosystems could decrease or might disappear completely. In that case, technical solutions would have to substitute services of ecosystems. This could increase costs that would otherwise have been saved by the initial conservation of ecosystems.

1.4 Forests

The forest is of the great importance for Liechtenstein. With a share of 41% of Liechtenstein's territory, its forests provide the biggest ecosystem in the country. Therefore, they are also the most important habitat for flora and fauna. For instance, around 338 plant species may be found in Liechtenstein's forests which correspond to 22% of the local vascular plant species.[17]

However, forests are not only of great importance to flora and fauna. The location of settlements and other infrastructures at the foot of forested slopes explains the significance of the forest as protection: 27% of the Liechtenstein forests provide an important or even essential protection of rock falls, avalanches or mudflows.[18]

The Liechtenstein forests also play a considerable role as provider of energy resources, especially with respect to burning wood. Total wood stock is approximately 2 million m^3 or an average of almost 400 m^3/ha. In the period between 1998 - 2010, the mean annual increment was about 7.9 m^3/ha. In the same period, the annual utilization was 6 m^3/ha. The entire forest in Liechtenstein has been certified according to the criteria of the Forest Stewardship Council (FSC) since 2001.

[14] Office of Forests, Nature and Land Management (2006), "Neobiota im Fürstentum Liechtensteins"

[15] http://geodaten.llv.li/geoportal/neophyten.html - as of July 2014

[16] Office of Environment (2013), „Die Magerstandorte des Fürstentum Liechtensteins"

[17] Broggi et al. (2006), „Rote Liste Gefässpflanzen"

[18] Nigsch (2009), „Der Schutzwald in Liechtenstein: Konzept zur Erhaltung und Verbesserung der Schutzleistung des Waldes"

In addition, the Liechtenstein Forests also provide several further important ecosystem services such as the production of fresh oxygen, purification of water and the stabilization of the local climate.[19]

Status und trends

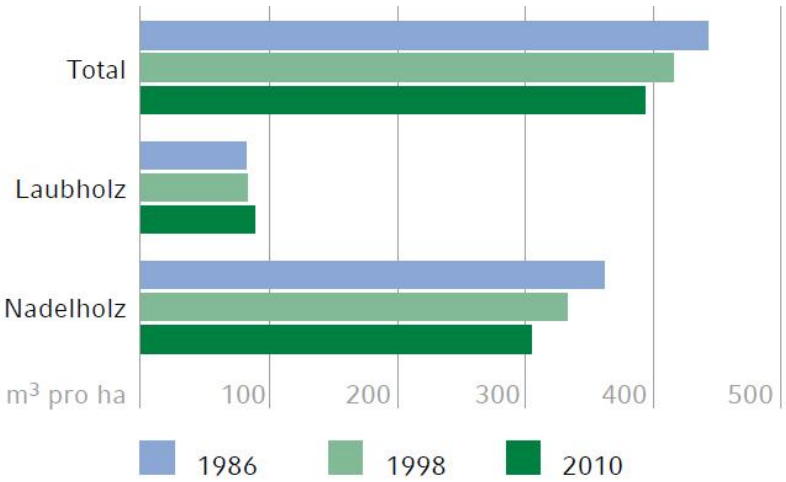
Conservation and promotion of biodiversity in the forest are based on the three pillars of nature-oriented silviculture, forest reserves and special forest areas, as well as small habitats worthy of protection.[20] According to the Forestry Act, important elements of nature-oriented silviculture are natural regeneration with local tree species appropriate to the location, the promotion of vertically structured forests, and the ecological improvement of forest margins. The use of pesticides and fertilizer is prohibited in the forest.

The promotion of biological diversity is playing an increasingly important role. Based on the Inventory of Nature Priority Areas in Liechtenstein[21], areas covering 1,879 ha or 27% of the total forest area were designated forest reserves or special forest areas in 2000. In the meantime, that share has experienced a decrease to 1'753 ha since some protected forest areas lost ground due to higher-ranking goals, e.g. the increase of landfill areas.

Supplementing the protection of habitats, there have also been initiatives in recent years to conserve and promote rare tree and shrub species (e.g. bladdernut (*Staphylea pinnata*), wild pear (*Pyrus pyraster*), yew (*Taxus baccata*), crab apple (*Malus sylvestris*)).

The Liechtenstein forest is developing towards a forest appropriate to its natural local conditions; this is proved by comparisons of the three national forest inventories from 1986, 1998 and 2010.

For instance, the wood stock in Liechtenstein has constantly decreased (Table 5). For several reasons the reduction of these volumes leads to positive assumptions. A forest that is only managed on low levels will have to bear a higher wood stock with the consequence of experiencing a higher forest density and a decreasing light penetrability for its soil. The result would be a decrease in biodiversity with respect to flora and fauna. The risk of storm losses increases and the natural regeneration of trees will suffer so that the forest status cannot be qualified as being sustainable anymore. Hence, from a biodiversity and stability point of view, it is feasible to focus on a reduction of wood volumes.



[19] Office of Forests, Nature and Land Management (2012). Landeswaldinventur 2010

[20] Näscher & Nigsch (2000) „Natur- und Landschaftsschutzkonzept für den Liechtensteiner Wald"

[21] Broggi et al. (1992). Inventar der Naturvorrangflächen

Tab. 5. Changes of wood volumes between 1986 and 2010[22]

The total share of deadwood increased from 20m^3/ha[23] in 1998 to 30m^3/ha in 2010. Dead wood is considered as an important habitat for several forest organisms such as mushrooms, bugs, moose, braids and fern.

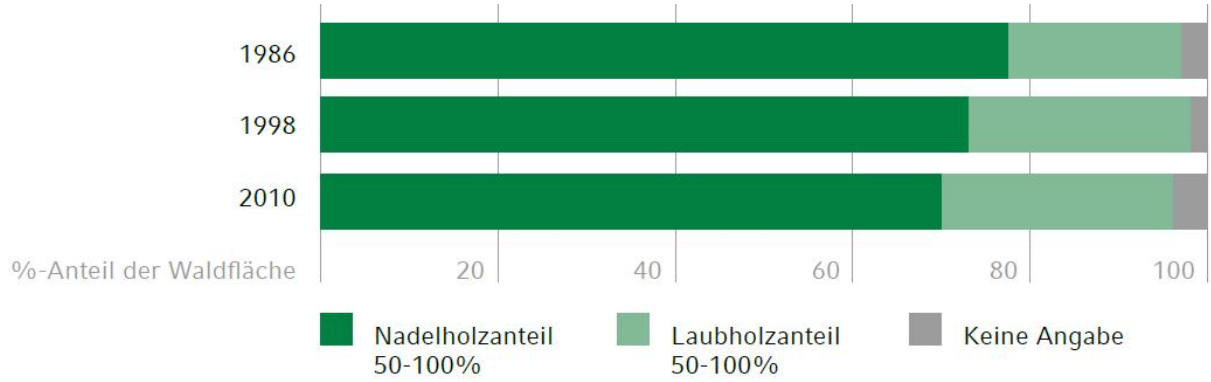
During the National Forest Inventory in 1998, 32 different tree species have been recorded, including the most common type of spruce (*Picea abies*) with a share of 52%. This share could be decreased by 1% until 2010 leading to an increased number of currently 42 tree species (Table 6).

Nadelbäume°	Stammzahl-anteil in %	Vorrats-anteil in %
Fichte	51	54
Tanne	5	7
Lärche	5	9
Föhre	10	7
Total (8 Arten)	71	77

Laubbäume°	Stammzahl-anteil in %	Vorrats-anteil in %
Buche	14	11
Esche	6	3
Ahorn	4	5
Übrige Laubhölzer	5	4
Total (34 Arten)	29	23

Tab. 6. Mixture of tree types in Liechtenstein's forests[24]

Over the last 20 years, measures have been undertaken to reduce the coniferous share in the naturally deciduous forest areas. The increase of mixed coniferous and deciduous stands at the expense of pure coniferous forests from 20% to 34% in the period from 1986-1998 confirms the effectiveness of the measures. The National Forest Inventory of 2010 also confirms this trend; the share of pure coniferous forests declined from 68% to 54%, while the share of pure deciduous forests further increased (Tab. 7).



Tab. 7. Distribution of the Liechtenstein forest into shares of coniferous and deciduous stands[25]

Within the forest stock the varying fractional cover of different tree population give indications with regard to the natural relation to each other. A regular growth density where the crowns do not interfere with each other indicates the healthy status of the forest stock. The observed increase within this

[22] Office of Forests, Nature and Land Management (2012), National Forest Inventory 2010

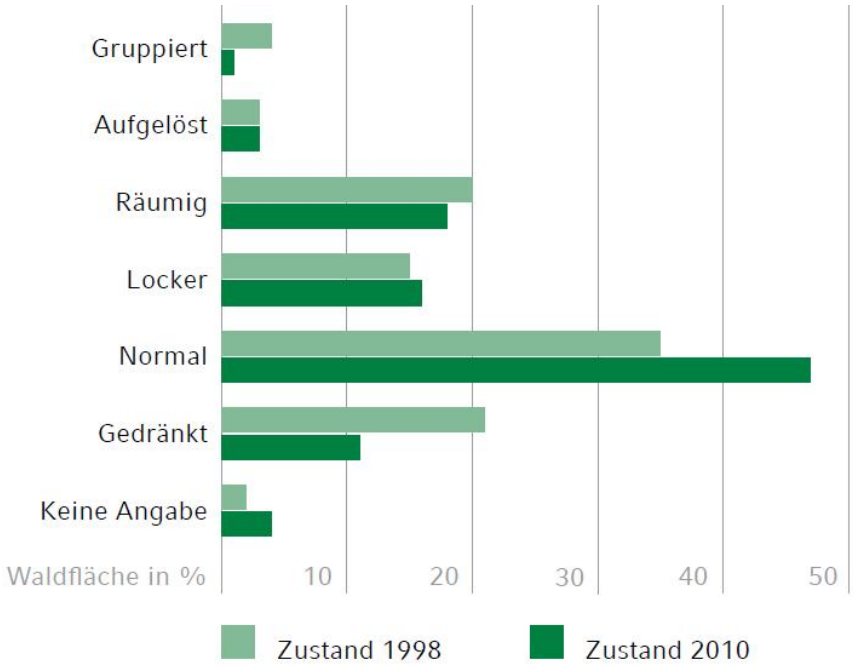
[23] Examinations of forest communities led to benchmarks of around 20-40 m^3/ha, in order to host typical organisms of dead woods (Bütler et al., 2006).

[24] Office of Forests, Nature and Land Management (2012), National Forest Inventory 2010

[25] Office of Forests, Nature and Land Management (2012), National Forest Inventory 2010

category from 35% in 1998 to 47% in 2010 is considered as a clear indication of the positive results of the respective forestry measures.

A comparison with the current status of the fractional cover and the status back in 1986, however, is not possible due to different inventory methodologies. Only the category “compressed tree cover” allows for a comparison with the year 1986. Back then, a share of 37% of the total forest area belonged to that category whereas in 1998 it has only been 21%. Today, the share of trees that fall under the category of “compressed tree Stock” is left with 11% of the total forest area (Tab. 8). From a forest management perspective this states a throughout positive development which is attributable to the efforts of the local forest services to focus on medium aged forest stands. These measures additionally improve the stability of the stands as well as the diversity of animal and plant species due to increased lighting.



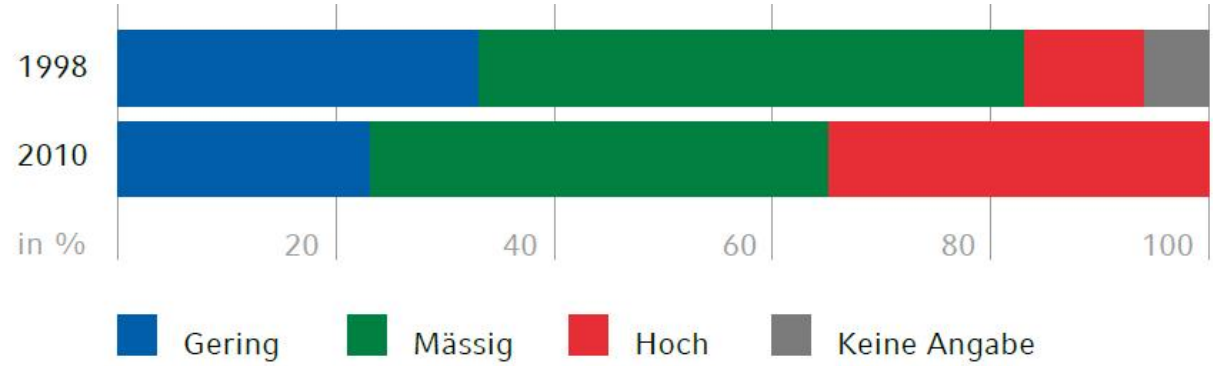
Tab. 8. Changes in growth densities of tree populations between 1998 and 2010[26]

Applying single indicators may help to visualize the development of forests. However, these visualisations only allow for a one-dimensional interpretation. In order to obtain a comprehensive overview, a combined interpretation of several different parameters is necessary. This may be proven by taking the structural diversity of forests. It encompasses criteria such as level of development, varying tree densities of different tree population, vertical structure, share of old-growth woods, occurrence of forest margins, gaps, shrub layer, berry shrubs, rootstocks, clumps of branches as well as grounded or vertical deadwoods. In Liechtenstein only 19% of the forests are considered to be diverse in that sense. One third of the total forest area only shows little structural diversity (Switzerland in 1996: 16%). To that regard and from a silviculture point of view there is still way for further improvement.

The biotope value is an ecological index which gives an indication with regard to the quality of natural habitats. Besides the structural diversity the biotope value also considers the orientation by nature and

[26] Office of Forests, Nature and Land Management (2012), National Forest Inventory 2010

the diversity of wood types as elementary. 35% of the forest areas in Liechtenstein have been allocated a high biotope value according to the mentioned indicators in 2010. In 1998 this value was down at only 11% of the forest area. The share of forest areas with a low biotope value has been reduced from 33% to 23%. The ambition of Liechtenstein's Forest Service and services to manage the countrywide forests in a more nature oriented manner has already shown first effects. However, there is still room for further improvement (Tab. 9).



Tab. 9. Changes in biotope values between 1998 and 2010[27]

Threats and losses

There are several threats to the nature-oriented forest and the sustainable performance of forest functions. The tendency toward overageing of stands and damage caused by browsing is of particular significance in Liechtenstein.

The regeneration of forests is a criterion of utmost importance for the sustainable function and services that forests may deliver. Since the costs of forest regeneration have to be beard today and its revenues will only become relevant in the future this criterion suffers from a constant lack of the required attention. This is problematic because safeguarding the next generation of forests states the most important task of today's forestry actions. Only the maintenance of a constant high share of young stands guarantees for instance the protective countrywide services of forests without interruptions. Taking into account these important considerations, the current development of regeneration must be described as disappointing: 25% of all spot samples taken did not show any regeneration of woods. 35% of the total forest area only shows a regeneration rate of 10% and less. Only 13% of all forest areas in Liechtenstein provide a high share of regeneration level of 50% and more.

While 29% of Liechtenstein's managed forests show a very low level of regeneration (0-4%) protection forests with 58% reach a level which is double that high. Protection forests often consist of old woods without regeneration which is an alarming indication. Half of all protection forests that are situated above settlement and infrastructural areas do therefore not even meet the minimal requirements of their necessary regeneration. Consequently future forestry measures should put a focus on a regeneration of protective forests if their protective functions should be kept.[28]

The inventorisation of forest damages through wild animals measured damages between 30 to 130 cm above ground and along the leading shoot. The respective percentage of browsing damages provides

[27] Office of Forests, Nature and Land Management (2012), National Forest Inventory 2010

[28] Office of Forests, Nature and Land Management (2012), National Forest Inventory 2010

useful information with regard to the grade of the total damage. If these grades are well below the thresholds, the forests in question would suffer an average loss of growth in height of at least 25%. These external interferences either lead to the die back of young woods or hinder their further growth and would cause a further loss in the forests biodiversity.

The share of browsing damages of all Liechtenstein wood species is around 25%. Since 1998 (27%) the share remained constantly high. In Switzerland, around 18% of forest plants suffer damages from browsing. However, huge differences occur within the different wood species.

In Liechtenstein, spruce, larch and ash trees show a level of browsing which is under the common thresholds. Maple trees on the other side reach a browsing level of 40%. The worst level with 51% shows the fir tree. This considerably high level may cause the extinction of these species in the midterm if the situation remains unchanged. [29]

Regarding invasive species within the Liechtenstein forests the need for action has constantly grown within the past years. Even though the share of invasive species according to the National Forestry Inventory 2010 can still be described as minimal, a strong increase of invasive species like the so called tree-of-heaven (*Ailanthus altissima*) or the evergreen honeysuckle (*Lonicera henryi*) has been observed within the last two to three years. This increase states a threat to biodiversity of tree species since both species belong to a very competitive and strong type. Moreover, species like the tree-of-heaven are also a threat to the protective function of forests. Compared to local tree species these species do not grow that old and very often suffer from core rot.

Another focus has to be placed on the currently spreading disease of the so called ash wilting. Around 6% of the Liechtenstein forests are ash trees. If this share would vanish within only a few years the forests could again risk losing their protective function. In addition, the remaining bare forest grounds might help the establishment of further invasive species.

[29] Office of Forests, Nature and Land Management (2012), National Forest Inventory 2010

1.5 Agriculture

With an agricultural area of 3'699 ha and an area dedicated to alpine pasture of around 1'780 ha the agricultural sector covers an area of 5'499 ha which corresponds to 33% of the total territory of Liechtenstein. On one hand this share serves the production of food for humans and farm animals. On the other hand it provides the second largest habitat for flora and fauna in Liechtenstein, after forests.

Status and trend

An agricultural reform was carried out in the 1990s, as a consequence of which price and income policy was decoupled and ecologizing measures were promoted. The legal foundations were created with the Law on Agriculture and its respective ordinances in 2008.[30, 31] In addition to conservation of soil fertility, environmental impact is to be minimized and extensification achieved. In the field of ecology, the reform promotes sustainable farming, soil-conserving cultivation, and extensive cultivation of near-natural habitats.

Sustainable Farming

The Proof of Ecological Performance (PEP) was introduced pursuant to the Customs Treaty with Switzerland: a minimum share of ecological compensation area, a balance of nutrients, regular crop rotations, compliance with water protection requirements, and soil conservation measures are prescribed by PEP. This has improved the situation from the perspective of resource protection. PEP is the precondition for entitlement to direct payments and is implemented on 99% of the agricultural area (Tab. 3). In addition to the Proof of Ecological Performance, 28% of farms also meet the criteria of organic farming (as of 2010).[32]

Table 3. Farms with Proof of Ecological Performance and organic production in 2010.

Measure	Area [ha] (2007)	Farms (2007)
Production with PEP	2621 (2630)	88 (85)
Organic Production	1020 (1048)	30 (35)
Total areas/farms	3641 (3678)	118 (120)
Total agricultural utilization	3669 (3743)	127 (127)

Near-natural habitats

For the purpose of cultivating near-natural habitats, ecological compensation focuses on promoting extensive use of pastures, low-intensive use of pastures, floral fallows, bedding meadows, and rough pastures. These near-natural areas cover 795 ha and thus about 21,6% of farmland.[33]

[30] Landwirtschaftsgesetz, LGBl. 2009 Nr. 42

[31] Verordnung über die Förderung von ökologischen Bewirtschaftungsarten in der Landwirtschaft, LGBl. 2010 Nr. 68

[32] Office of Statistics (2012). Landwirtschaftsstatistik 2010

[33] Office of Statistics (2012). Landwirtschaftsstatistik 2010

High-stem fruit trees are also supported. The ecological compensation areas were introduced into agriculture with the Soil Cultivation Act of 1992 and the Compensation Act of 1996. The number of ecological compensation areas then increased strongly until the end of the 1990s (Fig. 10). Since 2000, there has only been a modest increase and stabilization at around 21% of farmland.

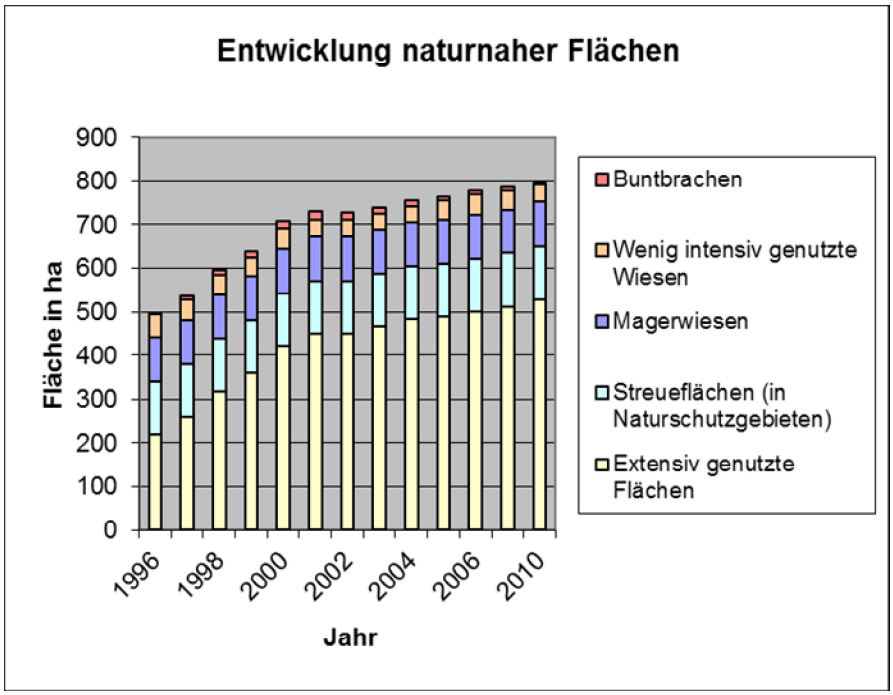


Fig. 10. Cultivated near-natural agricultural areas between 1996 and 2010.

A performance review mandated by law was carried out on the extensive pastures, which make up the largest share of ecological compensation areas. The review indicates a modest improvement. The elimination of fertilizer made the pastures rougher. The diversity of plants and invertebrates increased. However, there were practically no positive effects on the rare and threatened plant and bird species.[34] The study made clear that there is still upgrade potential. In addition to the ecological quality of the areas, this also is true of their distribution. The reasons include the selection of ecological compensation areas. With the exception of the inventoried rough pasture areas, the selection is made on the proposal of farmers and in accordance with commercial considerations. A proposed measure to improve the effectiveness for species diversity is therefore to enhance the ecological quality of the compensation areas by introducing quality-dependent subsidies and better habitat networks. The habitat networks should be enhanced by coordinating the allocation of areas and by designating focus areas for the ecological continuum.

Alp pastures

Covering 1,780 ha, alp pastures take up a considerable part of the Alpine region. As near-natural habitats, they contribute to the conservation of the diverse fauna and flora. The alp pastures are situated within the plant protection area of the mountain area (Chapter 1.3).

[34] RENAT (2008). Optimization of Ecological Compensation in Agriculture

Liechtenstein's Alps are well taken care of and accessible, thanks to financial subsidies for infrastructure and summering of livestock. Moreover, mountain area planning (Chapter 2.5) has led to a substantial reduction of grazing on extreme terrain and locations vulnerable to erosion. A review of grazing showed that stocking is appropriate to the terrain on nearly 90% of the areas.[35] Another positive development is the ban on nitrogenous mineral fertilizers. The previous ban on the use of herbicides was relaxed by way of ordinance to allow isolated treatment subject to approval.[36]

Preservation of genetic diversity

In the field of preservation of genetic diversity, the State of Liechtenstein has supported the project "Preservation of the Genetic Diversity of Cultivated Plants in Liechtenstein" since 2001. Dedicated inventories were compiled for fruit varieties, grapevines, vegetable varieties, and specifically for "Rhine Valley corn", a regional corn variety. The focus is on fruit varieties and Rhine Valley corn as a regional specialty. 130 apple and 100 pear varieties were found in the fruit category alone. However, none of the varieties found are limited to Liechtenstein. The conservation of high-stem fruit trees is promoted via ecological compensation in agriculture. In 2010, 9'006 high-stem fruit trees were covered by cultivation agreements. Fruit varieties classified as threatened are conserved in variety-specific orchards. Corn and vegetable seed is regularly cultivated and stored in cold storage rooms. Some of the seed is also stored in the Swiss GenBank.

The HORTUS association provides a platform for activities with regard to variety-conservation. The association is financially supported by the Government and the communities of Liechtenstein. From 2004-2008, HORTUS was the project partner in the Interreg project "Conservation of Pomaceous Fruit Varieties in the Lake Constance Region (Switzerland, Bavaria, Baden-Württemberg, Vorarlberg). As part of this project, a transnational project team researched traditional regional mixed orchards and developed measures for their conservation.

Threats and losses

Threats to biodiversity in the agricultural area arise from the potential for intensification due to good prices for products and possible expansion of infrastructures (e.g. industry, bypass roads) in the agricultural zone. The sprawl of settlements also represents a threat to the remaining high-stem fruit orchards. These orchards are often situated at the margins of today's settlements within the construction zones and are thus no longer enjoy long-term security.

1.6 Waters

In addition to the Alpine Rhine as the border river to Switzerland, three stream systems are important to the Liechtenstein water management (Inland Canal, Samina, Spiersbach). [37] All three flow into the Alpine Rhine. Other than a few small ponds (< 3 ha), there are no lakes in Liechtenstein. It is thus the streams that characterize the water system. They serve as natural habitat for flora and fauna and fulfil important interlinked functions within the landscape. In addition to that people often use water areas for recreation

[35] Stadler (2006). Location-appropriate Cultivation and Stocking of Alps in the Principality of Liechtenstein

[36] Alpinfrastruktur-Förderungs-Verordnung (AIFV), LGBl. 2009 Nr. 198

[37] Haidvogl & Kindle (2001). The Streams of Liechtenstein in the 19th and 20th Centuries

purposes. Many bicycle and hiking trails run along water areas, too. Amateur fishers as well enjoy the ecologically stable waters with respective fishing experiences.

Status and trends

According to the Water Protection Act[38], the goal of the country's approach to its waters is to transform them into a condition that is as near-natural as possible. In this way, the waters should be conserved as habitats for fish and other water organisms, as the Fishery Act sets out. [39] About 80% of the standing waters, most of which are artificial, have been integrated into the nature protection areas. [40] In contrast, only few of the streams are included as part of the protection areas.

Flow, networks and morphology

A water ecology study in 1983 showed ecological deficits mainly with respect to migration obstacles, lack of flow, and insufficient water morphology. [41] In the 1990s, numerous remediation projects were carried out to eliminate migration obstacles and to rehydrate desiccated waters.[42] The result is a more continuous water system with numerous rehydrated parts. The reason for the desiccation was the dropping of the groundwater level as a consequence of intensive removal of gravel from the Alpine Rhine in the 1950s to 1970s and the resulting drop of the Rhine bed. The rehydrated stretches make up about one quarter of the permanently aquiferous water stretches in the valley area.[43] The potential for rehydration is thus largely exhausted.

The deficit today is primarily due to the low variability of the flow pattern, caused by monotone water morphology. Surveys also show that a need for action mainly exists in the valley area. Rectified streams with monotone cross-sections predominate, which is partly due to the fact that drainage trenches in agricultural areas make up the largest share of stream stretches. More than half of the streams in the valley area are heavily impacted in terms of water morphology or are even non-natural. In the rest of the country, especially in the mountain area, the predominant share of waters is in contrast near-natural or not heavily impacted (Fig. 11).

The water morphology deficits pertaining to the Alpine Rhine are a consequence of rectification and flood protection structures as well as impacts by hydroelectric power generation. Due to upstream hydroelectric plants, the water level fluctuates by up to a meter each day (downsurge/upsurge problem). Adequate residual flow volumes, also in the case of hydroelectric power generation, are specified by law (Water Protection Act). Since 2014 updated water level fluctuates apply which should lead to an ecological improvement of these alpine waters.

[38] Gewässerschutzgesetz (GSchG), LGBl. 2003 Nr. 159

[39] Fischereigesetz, LGBl. 1990 Nr. 44

[40] Broggi et al. (1992). Inventory of Nature Priority Areas

[41] Broggi (1985). Ecological Inventory of Waters in the Valley Area of the Principality of Liechtenstein

[42] The desiccated waters were largely streams fed by groundwater in the area of the ballast body of the Rhine.

[43] RENAT (2006). Ecomorphology of the Streams in Liechtenstein

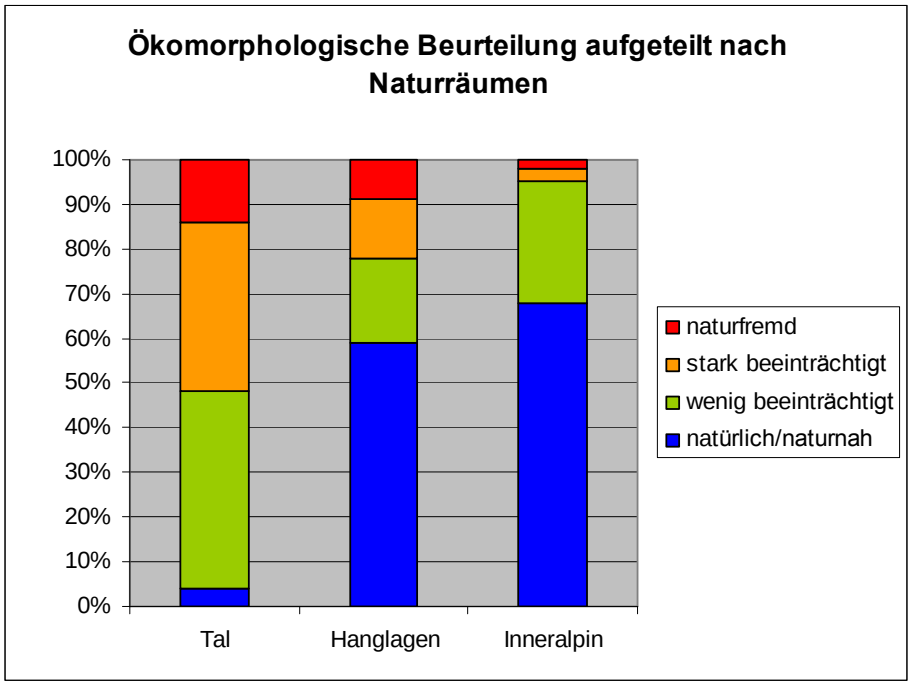


Fig. 11. Ecomorphological assessment of streams. In the valley area, 52% of the water stretches are heavily impacted or non-natural. This share declines from the slope areas to the mountain areas, where 95% of the water stretches are not heavily impacted or are near-natural.[44]

Chemical water quality

As a result of consistent implementation of waste water disposal, about 98% of all possible hookups are now connected to the central waste water treatment facility in Bendern. Additionally, special cultivation of stream shoulders has been carried out since 1994 with the goal of reducing the entry of nutrients from agriculture. Since 2011 the EU water framework directive (WFD) applies also in Liechtenstein due to its implementation into national law. The directive obliges Liechtenstein to examine the water quality in regular terms. The first such examination has been concluded in 2014. The results confirmed the high chemical water quality which has been reported in earlier examinations (Fig. 12).[45] [46] [47]

[44] RENAT (2006). Ecomorphology of the Streams in Liechtenstein

[45] The five ecological status categories according to the EU Water Framework Directive are: 1 = high, 2 = good, 3 = moderate, 4 = poor, 5 = bad.

[46] Office of Environment (2006). Chemische Gewässergüte Fliessgewässer Liechtenstein 2005/06

[47] Office of Environment (2014). Bestandsaufnahme und Überwachungsprogramme nach Wasserrahmenrichtlinie

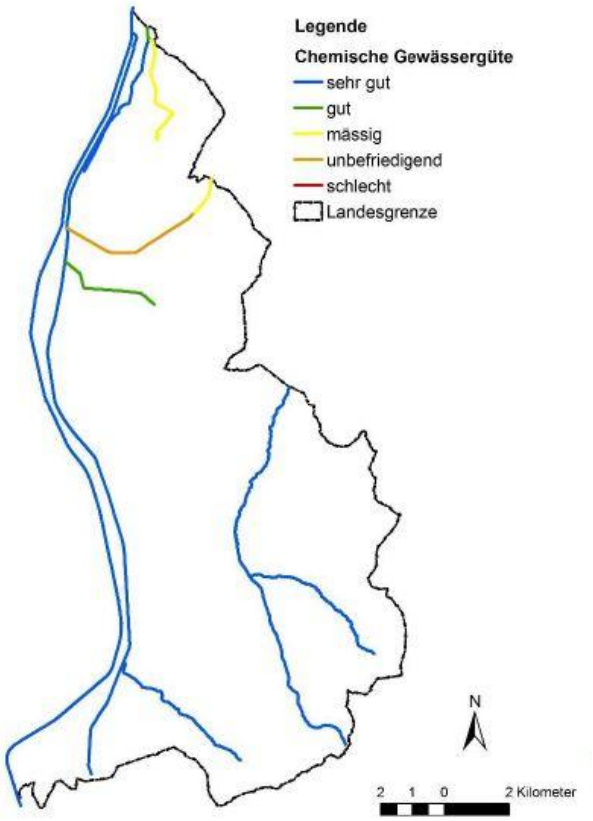


Fig. 12. Updated (2014) chemical water quality findings according to WFD. [48]

Biological water quality

Biological water status is assessed primarily on the basis of fishes, invertebrates (macrozoobenthos) and algae (phytobenthos). Phytobenthos was evaluated at two measurement points in the Liechtenstein valley area and Alpine Rhine. The Inland Canal and the Spiersbach, both inland streams, had a good ecological status with respect to phytobenthos. [49] The status of the Alpine Rhine along its Liechtenstein stretch is high.

With regard to the macrozoobenthos slight improvements have been observed compared to the first water status assessment in 2008 (Fig. 13). In summary, however, there are still deficits with regard to habitat quality within water areas in the valley region.

These findings are confirmed by surveys on the fish fauna in the valley area. The status of the surveyed inland waters in the valley area was poor. [50]

The quality situation in the Alpine Rhine has also decreased. Around the year 1850 about 30 fish species were reported in this region from which 25 to 27 were habituated along the Liechtenstein stretch of the Alpine Rhine. Today only 12 fish species exist between the Ellhorn and the Ill-outlet. These observation

[48] Office of Environment (2014). Bestandsaufnahme und Überwachungsprogramme nach Wasserrahmenrichtlinie

[49] Pfister & Hubmann (2008). Limnological Study of Selected Streams in Liechtenstein

[50] Peter et al. (2009). Evaluation of Four Liechtenstein Water Stretches with Respect to Fish Fauna

were made during electro fishing assessments in 2005 and 2013. Although it is were difficult to methodically assess the fish stock of the Alpine Rhine due to its current and turbidity an extensive decrease of species is obvious. This decrease is caused by stream basin development as well as the artificial water outlets which are linked to the use of hydro power by respective hydroelectric power plants. Completely vanished are these fish species that rely on slow stretches and dead stream branches along the Liechtenstein stretch of the Alpine Rhine.[51]

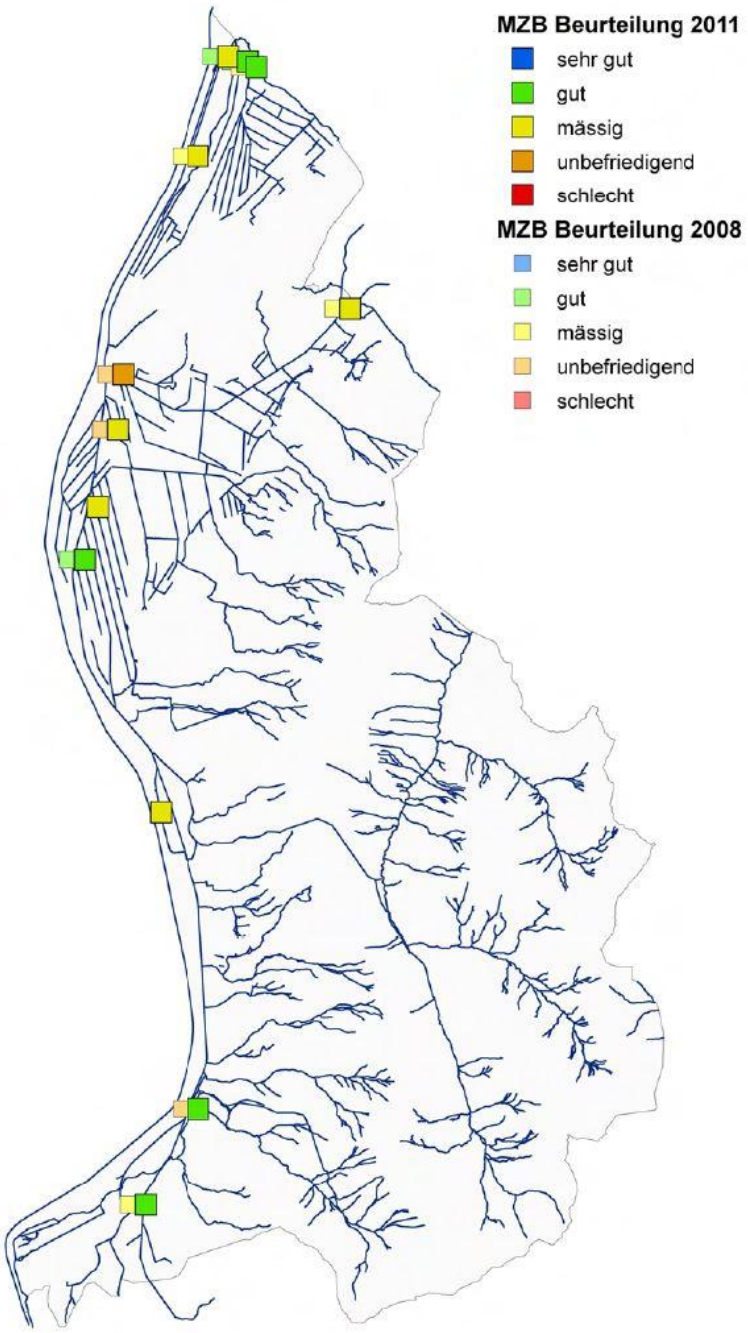


Fig. 13. Comparison of macrozoobenthos assessments from 2008 and 2011.[52]

[51] Bohl et al. (2014). Fish and Crayfish Atlas of Liechtenstein

[52] Office of Environment (2012). Biologische Fliessgewässerüberwachung im Fürstentum Liechtenstein - Zustandsbeurteilung 2011

Animal and plant species

The poor habitat quality of the waters in the valley area is seen in the threatened status of the animals and plants dependent on the water. In Liechtenstein, there are 26 fish and crayfish species as well as 54 vascular plants living in the water. [53] 62% of the domestic fish species and 61% of the water plants are on the Red List, and their stocks are thus threatened. A monitoring program for the fish stocks was launched in 2008.[54] For the time before that, the fishery statistics provided the most reliable information on the development trends of fish species used for fishery.

The fish catch statistics shows a decline in catches since the mid-80s in both of the important fishing streams, the Liechtenstein Inland Canal and the Alpine Rhine. Especially affected is the brown trout (*Salmo trutta fario*). The most prevalent fish species is still the imported American rainbow trout (*Oncorhynchus mykiss*), although its catch numbers have likewise been declining (Fig. 14).

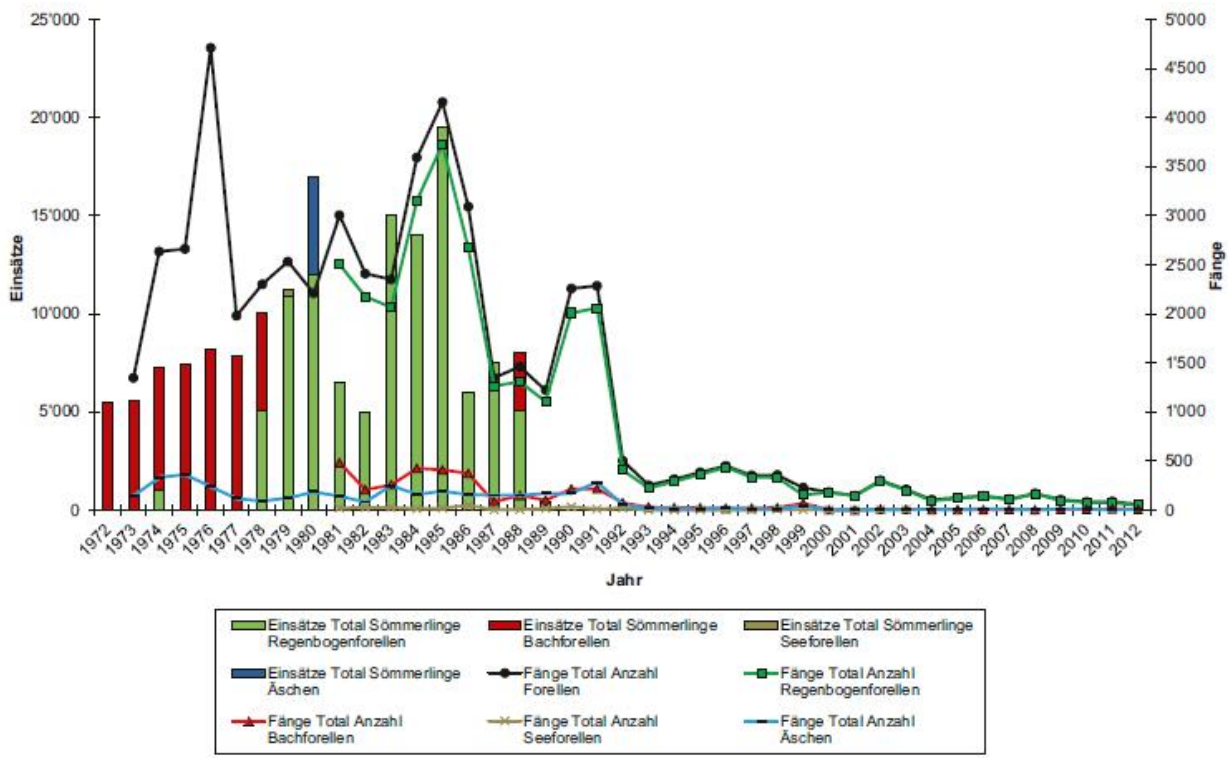


Fig. 14. Fish catch statistics 1972-2012 for the Liechtenstein stretch of the Alpine Rhine. [55]

Revitalizations

Revitalizations to upgrade the water morphology have been carried out on numerous water stretches in the valley area (Tab. 4). One milestone in regard to measures for the near-natural upgrading of streams was the revitalization of the outlets of the Liechtenstein Inland Canal and the Spiersbach[56] into the Alpine

[53] Bohl et al. (2014). Fish and Crayfish of Liechtenstein; Broggi et al. (2006). Red List of Vascular Plants

[54] Peter et al. (2009). Evaluation of Four Liechtenstein Water Stretches with Respect to Fish Fauna

[55] Office of Environment (2013). Fish Catch Statistics 2012

[56] The Spiersbach outlet is located in Vorarlberg, Austria. The respective revitalisation was made and financed by the competent authorities of Austria and Liechtenstein.

Rhine. These revitalizations ensured that the connection between the inland streams and the Alpine Rhine was restored even for weak-swimming fish. Data surveys near the outlet of the Inland Canal clearly show the success of revitalization at this key spot: while only 6 fish species were recorded before the revitalization measures, the number rose to 17 until 2014 in less than 4 years. [57]

Table 4. Implemented revitalizations of Liechtenstein water strechtes since 2000

Water area	Measure	Effect	Status	Year of imlementation
Esche	revitalization	morphology	implemented	2008
Inland Canal	revitalization	morphology	implemented	2009
Inland Canal	revitalization	morphology	implemented	2009
Inland Canal	revitalization	morphology	implemented	2013
Spiersbach Mündung	revitalization	morphology	implemented	2013
Vaduzer Giessen	revitalization	morphology	implemented	2005
Mühlebach Ruggell	revitalization	morphology	implemented	2005
Inland Canal Outlet	revitalization	patency	implemented	2000

Threats and losses

The implementation of the EU's WFD requires Liechtenstein to prevent deterioration of the status of all bodies of surface waters and also demands the amelioration of water areas in general. Therefore no further deteriorations as for example by construction works within the rivers are to be expected. Currently foreseeable changes and adverse effects to biodiversity within the field of hydrology may still occur. As the climate heats up, the outflow volumes may continue to decline and the water temperature may additionally rise in summer. This leads to expectations of a shift in the species spectrum among water organisms.

[57] Bohl et al. (2014). Fish and Crayfish of Liechtenstein

2 The National Biodiversity Strategy and action plan, implementation status

2.1 National Biodiversity Strategy 2020

Article 6 of the CBD calls for the development of a national strategy for the conservation and sustainable use of biological diversity. Based on the information gathered within the preparation of the 4th CBD Report Liechtenstein has developed a national biodiversity strategy. During 2009 and 2010 representatives of the Government and NGOs held several workshops on that topic. The workshop results lead to the conclusion of a strategy until 2020 in order to conserve and to ensure a sustainable use of biodiversity in Liechtenstein. The strategy is based on one overall target, four sub-targets and 12 strategy elements:

Overall Target

The conservation and sustainable use of biodiversity is ensured.

Sub-targets

U1) We recognize biodiversity as core element for the conservation of nature, including food and livelihood, and take regard of its value and effects on nature.

U2) We ensure and support biodiversity by the legally binding designation of nature protection areas.

U3) We make use of our resources in a sustainable manner and under consideration of biodiversity targets.

U4) We take responsibility for our fair share of global biodiversity.

Strategy

Strategies to U1 - We recognize biodiversity as core element for the conservation of nature, including food and livelihood, and take regard of its value and effects on nature:

S1) We take responsibility with regard to biodiversity throughout all policy areas;

S2) we implement targets of biodiversity into planning- and steering processes of public and private actors;

S3) we conduct research and status assessments with regard to biodiversity and its effects on nature;

S4) we support capacity building with regard to biodiversity.

Strategies to U2 - We ensure and support biodiversity by the legally binding designation of nature protected areas:

S5) We conserve the most important habitats and species by designating nature protection areas;

S6) we conserve biodiversity and its effects on nature outside of nature protection areas by specific means of support;

S7) we support measures for the compensation of impacts on biodiversity caused by climate change.

Strategies to U3 - We make use of our resources in a sustainable manner and under consideration of biodiversity targets:

S8) We seek a high standard of life quality throughout the whole country's territory;

S9) we avoid losses of biodiversity through sustainable use activities in all economic areas;

S10) we deal with invasive species in an adequate way.

Strategies to U4 - We take responsibility for our fair share of global biodiversity:

S11) We support programmes and projects related to the conservation of biodiversity and its effects on nature within multilateral corporation;

S12) we support projects abroad that contribute to the conservation and sustainable use of biodiversity.

2.2 National Action Plan on Biodiversity 2020

Based on the National Biodiversity Strategy Liechtenstein developed a respective action plan during the UN Year of Biodiversity in 2010. The action plan links at least one measure (action) of implementation to respective elements of the National Biodiversity Strategy. The action plan also provides information on the competent authorities and the dates of intended implementation. The Biodiversity Strategy as well as the National Action Plan 2020 was passed by the Government in 2010.

Action Plan

Actions to S1 - we take responsibility with regard to biodiversity throughout all policy areas:

Action	Description	Responsibility	Time
A1-S1	Clarification of organisational structure within Liechtenstein's National Museum	Ministry for Infrastructure, Environment and Sport (MIU)	2010

Actions to S2 - we implement targets of biodiversity into planning- and steering processes of public and private actors:

Action	Description	Responsibility	Time
A1-S2	„Bauen mit Natur und Landschaft", publication by the Office of Forests, Nature and Land Management (AWNL) (June)	Office of Environment (AU)	2010
A2-S2	Development of management plans considering potential mudflows and its corresponding infrastructure and biodiversity impacts	AU/ Office of Civil Protection (ABS)	- 2018

Actions to S3 - we conduct research and status assessments with regard to biodiversity and its effects on nature:

Action	Description	Responsibility	Time
A1-S3	Mammal inventory	AU	2011/12
A2-S3	Establishment of a comprehensive monitoring concept for long term biodiversity development (criteria, indicators)	AU	- 2012

Actions to S4 – we support capacity building of biodiversity:

Action	Description	Responsibility	Time
A1-S4	Open Day at Landesforstbetrieb (October)	AU	2010
A2-S4	Announcement of the UN Year of Biodiversity in April 2010 along with a digital exhibition about the habituated flora and fauna; introduction of the National Biodiversity Strategy 2020	AU/MIU/ Botanisch-Zoologische Gesellschaft (BZG)	2010
A3-S4	„Bauen mit Natur und Landschaft“ – excursions to several communities (practical project insights) – summer, spring 2010: nature greening of rooftops organized by LGU	AU/Liechtensteinische Gesellschaft für Umweltschutz (LGU)	2010
A4-S4	„Forest and Nature Protection“ – AWNL-publication (Nov. 2010)	AU	2010
A5-S4	Conclusion of UN Year of Biodiversity 2010 including topic related presentations (Dec. 2012)	AU	2010
A6-S4	Labeling/Signposting of designated nature protection areas	AU	2010/11
A7-S4	Organization of events with biodiversity related topics (hedge and forests maintenance, dry stone walls)	AU, NGOs	- 2020
A8-S4	Set-up of a website dealing with biodiversity, www.natur.li	AU	2010
A9-S4	Botanic excursion of the BZG, together with the Swiss Botanic Society	BZG	2010
A10-S4	Planting Plants Days in several kindergarden hosted by local forest services	Forest Services	2010
A11-S4	Capacity building for teachers	AU	2010
A12-S4	Excursions organized by AWNL	AU	2010

Actions to S5 - we conserve the most important habitats and species by designating nature protection areas:

Action	Description	Responsibility	Time
A1-S5	Designating the area of Bofel – Langwiesen (Triesen, Balzers) as nature protection area by law	AU	2010/11
A2-S5	Designation of wildlife areas and zones for winter rest of	AU/Liechtenstein	2010

	wild animals	Hunters	
A3-S5	Designation of the area Stauden (Gamprin, Ruggell) as nature protection area by law	AU	- 2013
A4-S5	Designation of further protection areas according to the Inventory of Nature Priority Areas	AU	- 2020
A5-S5	Implementation of the Inventory of Nature Priority Areas regarding biotope	AU	- 2015
A6-S5	Protection of the Mareewiesen (Vaduz) by City of Vaduz and Liechtenstein	AU/LGU	2010
A7-S5	Clarification of protection goals with regard to individual special forest areas and organization of implementation measures	AU	2010
A8-S5	Assessment of the effectiveness of measures that are intended to protect and maintain protected areas	AU	- 2018

Actions to S6 - we conserve biodiversity and its effects on nature outside of nature protected areas by specific means of support:

Action	Description	Responsibility	Time
A1-S6	Implementation of Inventory of Nature Priority Areas regarding natural monuments	AU	- 2012
A2-S6	Adaptation of Art. 2 Forest Act (forest definition) as basis of the ENL-concept	AU/MIU	2010
A3-S6	Implementation of ENL-conept, especially protection of networking links	AU	2010 - 20
A4-S6	Ongoing re-naturisation of streams according to criteria of biodiversity	AU/ (ABS)	- 2020
A5-S6	Managment of wild animal feeding program at Ställa-Schwabbrünnen	AU/Office of Construction and Infrastructure (ABI)	2010 - 12
A6-S6	Raising the protection status of the remaining commons and its conservation as park area	AU	- 2015

Actions to S7 - we support measures for the compensation of impacts on biodiversity caused by climate change:

Action	Description	Responsibility	Time
A1-S7	Showing the consequences of a temperature increase of 2 C^{o} for the Liechtenstein forest and mountain areas and organisation of public discussions around appropriate	AU	- 2015

	adaptation measures		

Actions to S8 - We seek a high standard of life quality throughout the whole country's territory:

Action	Description	Responsibility	Time
A1-S8	Conservation of free and natural landscapes and nature-oriented areas outside of settlement areas	Communities, Government, AU	- 2020

Action to S9 - we avoid losses of biodiversity through sustainable use activities in all economic areas:

Action	Description	Responsibility	Time
A1-S9	Support of regional products sales	AU/LGU	2010 -20

Actions to S10 - we deal with invasive species in an adequate way:

Action	Description	Responsibility	Time
A1-S11	„Das Schwarzwild kommt" – public oral presentation	Silberner Bruch	2010
A2-S11	Development of a specific step-by-step approach with regard to activities related to - competencies/contact persons - early recognition - monitoring	AU	- 2014

Actions to S11 - We support programmes and projects related to the conservation of biodiversity and its effects on nature within multilateral corporation:

Action	Description	Responsibility	Time
A1-S13	Cross-border corporation with respect to the conservation of the moorlands between Ruggell and the Ill outlet	AU	- 2020
A2-S13	Egelsee	AU/ABS	2010

Actions to S12 we support projects abroad which support biodiversity.

Action	Description	Responsibility	Time
A1-S14	The Government together with the Liechtensteinstein	Office for Foreign	2020

	Development Service (LED) provide development aid and therefore contribute to a sustainable use of biodiversity	Affairs /LED	

2.3 Implementation of the Strategy and the Action

Actions to S1 - we take responsibility with regard to biodiversity throughout all policy areas:

The organisation of the structure within Liechtenstein's National Museum has been clarified in due time.. The state-owned biology collection got its home at the National Museum within a permanent exhibition. The respective exhibits are now accessible to the public, especially for educational purposes.

With regard to the further content of S1 it should be mentioned that due to the small size of the country conflicts of interest occur very often when it comes to the conservation of biodiversity. Consequently balancing the various interests mostly takes place on a political level, especially with regard to the question if biodiversity is given priority in relation to other interests. The obvious conflicts in space requirements with regard to revitalisation of water courses may serve as an example. These areas are often used agriculturally and therefore by law enjoy a priority in conservation.[58] In most cases policymakers have given, however, priority to the area improvement as a living environment. Another actual example is the balance of interest between building a new cycleway along a nature protection area and through a wildlife corridor. The decision whether non-motorized transport or the conservation of biodiversity should be given priority is still pending.

Generally the interests of agriculture, nature and landscape, including biodiversity always form part of the basis of decision-making within Liechtenstein's policies. The respective decisions are however not always in favour of biodiversity interests.

Actions to S2 - we implement targets of biodiversity into planning- and steering processes of public and private actors:

Both targets under this action plan have been reached in time. The broschure „Bauen mit Natur und Landschaft" of the former Office of Forests, Nature and Land Management (AWNL) was published in 2010. The brochure is dedicated to future building owners and aims at putting a focus at these building and construction activities where aspects of nature and landscape may be considered and a respective contribution to biodiversity could be possible. This could for instance be the case when planning the compound boundaries to the neighbours or to the public space. The same is true for the adequate choice of plants. The brochure provides some incentives, ideas and information on how natural habitats may be conserved and further developed.

Since 2012 the Office of Environment and the Office for Civil Protection conduct annual meetings in order to exchange on new constructions or renovations of mudflow (debris flow) infrastructures. The exchanges ensure that aspects of biodiversity are considered at all time. For instance all through earthwork artificially build ruderal sites in areas with a high risk of neophytes have been greened with local plants immediately afterwards in order to avoid the settlement of neophytes.

With regard to this strategy element it should be mentioned that biodiversity targets are already implemented in many public and private planning and steering processes. One of the most important elements with regard to spatial planning is the "National Master Plan" (a countrywide land use plan) and their linked community land used plans.[59] The National Master Plan as well as the community use land

[58] Gesetz über die Erhaltung und Sicherung des landwirtschaftlich nutzbaren Bodens, LGBl. 1992 Nr. 41

[59] Baugesetz (BauG), LGBl. 2008 Nr. 44

plans have experienced a growing attention towards the interests of nature and landscape over the past years.

In addition to that land use plans generally have to go through a strategic environmental impact assessment (SUP).[60] Concrete bigger buildings have to be checked against an impact assessment of environmental sustainability (UVP)[61] and smaller buildings outside of construction zones need to comply with the intervention procedures of the Nature Protection Act (NSchG). [62]

This top-down approach ensures that the interests of nature and landscape within area planning are adequately respected. In addition to that a legal loophole within the Nature Protection Act has been removed in 2013. From 2013 on the law now requires a separate assessment of environmental impacts in cases where a reclassification of non-building land into building land is requested. It is now ensured that sensitive nature areas, habitats or forest sites and natural monuments according to the Inventory of Priority Areas are no longer destroyed without compensation.

Actions to S3 - we conduct research and status assessments with regard to biodiversity and its effects on nature:

The Actions to A1-S3 have been implemented in due course; the mammal inventory has been set up and published. Action A2-S3, which aims at the establishment of a comprehensive monitoring concept for the long-term biodiversity development could not have been implemented as envisaged. Although a meeting with experts from Hintermann and Weber AG who are in charge of managing the national biodiversity monitoring programme of Switzerland took place the further project implementation was stopped due to the high annual costs which were associated with the monitoring. Due to the extraordinary division into landscape units the amount of required random samplings per habitat in order to receive adequate results on biodiversity aspects was considered as too high taking into account the small size of the country. Hence, the project has been postponed until further notice. Meanwhile the existing concept of research and monitoring will continue. That means that important indicators like birds, fishes, plants, reptiles, etc will be mapped in 10-20 year terms. The results will be compared with earlier findings. In the future attention will be given to the applicable methodology in order to ensure that the mapping is reproducible and applied over different sites in the country. These data will be digitally stored in a biodiversity database. It will also be ensured that the Red Lists will be managed according to IUCN criteria.

In addition it is planned to further develop a Liechtenstein database on biodiversity where all collected data with regard to flora and fauna is stored. Based on that data information it is envisaged to develop a better monitoring, especially with regard to building and area planning activities.

In line with the strategy several mappings on rough pasture habitats, on mammals as well as on fishes and crayfish have been launched and concluded. Activities with regard to the mapping of breeding bids in Switzerland and Liechtenstein are currently ongoing. Based on these outcomes a breeding birds atlas will be published in 2018.

[60] Gesetz über die Strategische Umweltprüfung (SUPG), LGBl. 2007 Nr. 106

[61] Gesetz über die Umweltverträglichkeitsprüfung (UVPG), LGBl. 2014 Nr. 19

[62] Gesetz zum Schutz von Natur und Landschaft (NSchG), LGBl. 1996 Nr. 117

Action to S4 - we support capacity building with regard to biodiversity:

The majority of actions within in the action plan have been implemented in time. In 2013 all nature protection areas have been re-signed. In the course of 2014 the wild animal zones will be re-signed accordingly. All measures from the action plan under S4 have thus been implemented.

Besides these action plan related targets the Office of Environment and several private environmental NGOs organise numerous relevant public relation activities (publications, excursions, presentations, etc) throughout the year. Every 7 years a specific so called Forest Day is organized where students of Liechtenstein will be given lessons within the forests about the forest and its functions. Other relevant topics such as waters or energy are dealt with in schools during special thematic days. In addition natural science forms an integrated part of the curriculum in Liechtenstein schools. Knowledge about nature, landscape and biodiversity is therefore delivered and supported to Liechtenstein students of all ages.

Actions to S5 - We conserve the most important habitats and species by designating nature protection areas:

By the end of 2011 and after period of more than 30 years Liechtenstein allocated a faunistically valuable area the legal status of a nature protected area.[63] One year later the next designation of a nature protected area followed, raising the total amount of such areas in Liechtenstein to eleven.[64] Legal protection was also achieved with regard to wild animals due to the respective designation of new wildlife areas and zones for winter rest.[65] The designation of these new and spacious zones did not enjoy full support within the country's population and is therefore currently under review. Additionally in 2013 the first legally protected landscape has been designated. [66] In sum the actions A1, A2, A4, A5 and A6 have been fully implemented on time.

Further designations of eligible natural areas according to the Inventory of Nature Priority Areas are currently under consideration.

Generally the past 2 years saw more designations of nature protection areas/landscapes than the previous 30 years. Considering the small size of the country and the fact that diverse interests of land use within the very limited space available may constantly lead to certain conflicts the achieved designation of new protected areas can be described as success.

Actions to S6 - we conserve biodiversity and its effects on nature outside of nature protection areas by specific means of support:

Liechtenstein's natural monuments are recorded in the Inventory of Nature Priority Areas. However, currently these monuments do not enjoy any legal protection. In order to change this situation the Inventory of Nature Priority Areas is currently under review. The assessment will be concluded in 2014/15 and be followed by the enactment of a respective ordinance in order to allocate Liechtenstein's natural monuments the legal protection they deserve.

[63] Verordnung über das Naturschutzgebiet „Matilaberg" in der Gemeinde Triesen, LGBl. 2011 Nr. 521

[64] Verordnung über das Naturschutzgebiet „Mareewiesen" in Vaduz, LGBl. 2013 Nr. 1

[65] Verordnung über den Wildtierschutz (WTSchV), LGBl. 2012 Nr. 381

[66] Verordnung über das Landschaftsschutzgebiet „Periol, Bofel, Neufeld, Undera Forst" in der Gemeinde Triesen (LGBl. 2013 Nr. 311)

The adaptation of Liechtenstein's Forestry Act with regard to the definition of forests will be implemented in 2015 (A2). The implementation of actions A3 to A6 is currently on hold due to a lack of human resources and financial means.

Actions to S7 - we support measures for the compensation of impacts on biodiversity caused by climate change:

The preparations for a national adaptation strategy on climate change are almost completed. The respective measure formulated under S7 will be implemented in due time.

Actions to S8 - We seek a high standard of life quality throughout the whole country's territory;:

The conservation of free and natural landscapes and nature-oriented areas outside of settlement areas as a measure under S8 may also be considered as outcome of other measures contained within the action plan. To that respect all measures under S5 contribute to the fulfilment of the mentioned conservation. The same is true for some measures under S2.

At the legislative level Liechtenstein has only established a few provisions within the field of spatial planning.[67]

Especially the so called land use plans and some specific legal provisions provide the framework for Liechtenstein's area planning. The most important legal measures that control a further extension of settlement compounds and provide means to mitigate a scattered urbanisation are the nature protection areas based on the Nature Protection Act (NSchG) and Waters Protection Act (GSchG) as well as the Building Act (BauG) which defines the construction scope within the separate zones based on the respective Master Plans and land use plans. A reclassification into building land may only be granted if a corresponding demand is proved. Such demand does currently not exist in any of Liechtenstein's 11 communities.[68]

Besides these legal and planning measures it should be mentioned that a superregional urbanisation program has been developed two years ago. The program's goal is to mitigate the ongoing scattered urbanisation in the region.[69]

Action to S9 - we avoid losses of biodiversity through sustainable use activities in all economic areas:

The establishment of the "Foundation Agrarmarketing Liechtenstein" in 2008 stated the beginning of action A1 under S9. In order to further strengthen the partnership between farmers and consumers and to support the sales of regional products the foundation has developed the brand «natürlig vo do». Such brands provide information to consumers with respect to the product's origin and serves as an additional purchase argument. Products that are labelled with «natürlig vo do» stand for fresh products with short transportation distances.

Marketing regional products contributes to an increase of value added and serves the conservation of regional structures and traditions.[70]

[67] Baugesetz (BauG), LGBl. 2008 Nr. 44

[68] http://www.agglomeration-werdenberg-liechtenstein.ch/pdf/110811_Synthesebericht_mAnhang.pdf - Seite 34, Abb. 4

[69] http://www.agglomeration-werdenberg-liechtenstein.ch – as of July 2014

Within the forestry sector the community "Holzkreislauf" aims at similar goals, since it supports a sustainable utilization of forests. [71]

This measure can, however, not be realized in other economic sectors since Liechtenstein does not have any other natural or marketable resources and due to its small size the potential demand (in absolute terms) would be considerably small as well. Consequently many resources are imported to Liechtenstein for further processing before they are exported again. The service sector, however, takes a more important role at least to certain extends. In this context the activities of the Carlo Foundation and LIFE Climate Foundation Liechtenstein are noteworthy. Carlo Foundation focus on the implementation of a rating system for financial products based on various sustainability indicators. LIFE Climate Foundation also covers sustainability issues within its activities. By organizing public events and publishing articles on regular bases the activities of LIFE Climate Foundation contribute to a rising awareness in the Liechtenstein population with respect to environmental topics.

Action to S10 - we deal with invasive species in an adequate way. :

All measures listed under S10 were implemented in due time. With the enactment of the Organism Act and its corresponding ordinances in 2011 the legal grounds to deal with invasive organisms were set. [72] [73]

Based on these legal grounds the Government developed a neophyte concept, including a respective action plan. A designated focal point was established at the Office of Environment in order to address problems related to neophytes in a centralized manner. In addition, in 2013 a web-based geo information system (GIS) was introduced which besides other tasks records the types and locations of all known neophytes in Liechtenstein.[74] Consequently the evolvement of new neophyte or the extensions of neophyte areas are detected much earlier with GIS. Besides that GIS is extremely helpful in order to qualify potential new problematic areas and thus helps to work out the appropriate national priorities with respect to neophyte counter measures.

One result of the GIS observations is for instance that the invasive goldenrod in the biggest nature protected area the Ruggeller Riet is mowned three times a year.

First positive effects occurred 2014 when GIS data was compared to data from previous years. Definitive results will be available soon based on GPS-based measurements of the recorded neophyte stock. The awareness for problems that come along with invasive species is constantly rising – on both countrywide and community levels. The latter is proven by the growing number of volunteers that help the communities at specific "neophyte days".

[70] http://www.vodo.li/ - as of July 2014

[71] http://www.holzkreislauf.li - as of July 2014

[72] Gesetz über den Umgang mit genetisch veränderten, pathogenen oder gebietsfremden Organismen (Organismengesetz; OrgG), LGBl. 2011 Nr. 4

[73] Verordnung über den Umgang mit pathogenen oder gebietsfremden Organismen in der Umwelt (Freisetzungsverordnung; FrSV), LGBl. 2011 Nr. 90

[74] http://geodaten.llv.li/geoportal/neophyten.html - as of July 2014

Action to S11 - We support programmes and projects related to the conservation of biodiversity and its effects on nature within multilateral corporation:

Multilateral corporation plays an important role within the external relations of Liechtenstein. In that context Liechtenstein constantly provides financial as well as human resources for multilateral based projects. Special attention is given to international cooperation with the neighbouring countries Switzerland and Austria. The Ministry for Infrastructure, Environment and Sport coordinates the contributions to projects of sustainable development and environmental projects.

The cross boarder cooperation with the authorities of Vorarlberg (Austria) in order to conserve the moorlands between Ruggell (FL) and the Ill outlet (A) is an ongoing project with an open time horizon. In 2013 two onsite visits took place at the Rugeller Riet (FL) and Bangser Riet (A). The aim of the meeting was to agree on joint measures to further mitigate neophyte development at these locations.

The project "Egelsee" a joint initiative of Liechtenstein and Austria was successfully concluded in 2012/2013. The (new) Egelsee is a small lake that is located directly on the border line of Liechtenstein and Austria and serves as a retention lake especially during heavy rainfalls. In addition to that the Egelsee also provides an ecological upgrade for flora and fauna.

Action to S12 - we support projects abroad that contribute to the conservation and sustainable use of biodiversity.

The conservation of the environment and the support for a responsible and sustainable use of natural resources forms a core element of Liechtenstein's international humanitarian cooperation and development. Liechtenstein's bilateral development corporation lies within the responsibility of the Liechtenstein Development Service (LED). The corporation focuses on food security in rural areas. To that respect LED envisages a corporation with the local farmers since they play a key role in most developing countries. It is worth mentioning that the promotion of ecological farming forms an integrated part of every agricultural corporation. A list of current projects is available of the LED's website.[75] LED is currently engaged in 13 priority countries (Fig. 15).

[75] http://www.led.li – as of July 2014

Fig. 15. Priority countries of LED.[76]

[76] http://www.led.li/strategie/schwerpunktlaender.html - Stand Juli 2014

3 Progress towards the CBD-Targets

3.1 Progress towards the strategic plan of the convention

Already when it ratified the Convention in 1997, Liechtenstein analysed its existing legislation. The review showed that the legal foundations were sufficient to honour the obligations under the Convention. In the meantime additional adaptations have been made to better address the requirements under the convention. For instance new laws were passed, existing laws were adjusted where necessary (Organism Act, Nature Protection Act, etc.) and a national biodiversity strategy including a respective action plan has been developed.

3.2 Aichi-Biodiversity Targets

By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.

A representative survey among the Liechtenstein population has not been conducted as of today. However, the growing number of participants at excursions, public action days, oral presentations and other relevant events lead to the assumption that the awareness of the Liechtenstein population with regard to biodiversity values is constantly rising and that its knowledge of how to contribute to the conservation and sustainable use of biodiversity is advancing. The target should be met by 2020.

By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.

As elaborated in Chapter 2.2 aspects of biodiversity need to be considered by law (SUP[77], UVP[78], NSchG[79]) at any activity linked to area planning. Further contributions to a sustainable development of the country are provided by the implementation of the biodiversity strategy as well as the adaptation strategy on climate change. Poverty alleviation is not addressed since poverty as defined under the CBD does not occur in Liechtenstein. Up to know biodiversity values or ecosystem related services have not been transferred into monetary values (in Swiss Francs) with national accounting. In order to achieve such accounting further research needs to be done, for instance the conclusion of a national TEEB-Study.[80] This target will thus be only achieved partly in 2020.

[77] Gesetz über die Strategische Umweltprüfung (SUPG), LGBl. 2007 Nr. 106

[78] Gesetz über die Umweltverträglichkeitsprüfung (UVPG), LGBl. 2014 Nr. 19

[79] Gesetz zum Schutz von Natur und Landschaft (NSchG), LGBl. 1996 Nr. 117

[80] TEEB : The Economics of Ecosystems and Biodiversity

By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.

Due to governmental budget consolidation over the past few years several subsidies have been cut down or have been removed completely – regardless of their effects on biodiversity. New incentives have also been put on hold due to budget consolidation. The only economic sector that still receives considerable financial support is the agricultural sector, including nature as a subsector when it comes to the conservation of rough pastures. Within the countrywide budget cut of the Government the financial contributions to the agricultural sector have been spared. The target should be achieved by 2020.

By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.

With respect to local species that target has already been achieved. Import and export of endangered species is regulated by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) to which Liechtenstein is a contractual party.

Sustainable use of natural resources is given priority in Liechtenstein. Within spatial planning the forest and agricultural areas are the most important sectors. All Liechtenstein forests are FSC-labelled today. Measures in favour of nature-oriented forestry are complemented by nature protection areas. Complications occur within the sustainable regeneration of woods because peel and bite damages of wild animals. Especially the red deer stock succeeds its habitual capacity and therefore negatively impacts the regeneration of woods.

Around 30% of Liechtenstein's farmers manage their business in accordance with the guidelines on ecological agriculture. In order to be entitled to receive governmental subsidies it is necessary to prove that the subsidised activities apply the "Good agricultural Practice" (Gute Landwirtschaftliche Praxis, GLP) and can demonstrate an ecological performance record (Ökologischer Leistungsnachweis, ÖLN). The ÖLN encompasses measures like proper nutrient balances, regular crop rotation or measures of soil protection.

This information only refers to factors within Liechtenstein. But Liechtenstein is in particular also an import country, which raises the question of whether the environmental impacts are exported. Unlike the assessment of exports, imports are difficult to gauge due to Liechtenstein's participation in the Swiss customs areas. No survey of the sustainability of Liechtenstein imports has thus been undertaken so far.

Due to the economic similarity (customs union), it must be assumed that the consumption of imported goods and the ecological footprint are at about the same level as in Switzerland (Fig. 16).

Relatively spoken, Liechtenstein's consummation rate is thus 3 times higher than the available resources on earth. Liechtenstein's CO_2 emissions account for around 65% of this negative footprint. Although

Liechtenstein endeavours to reduce its emissions for several years now and considering the ecological footprints of imported goods it can be assumed that the abovementioned target may not be achieved by 2020.

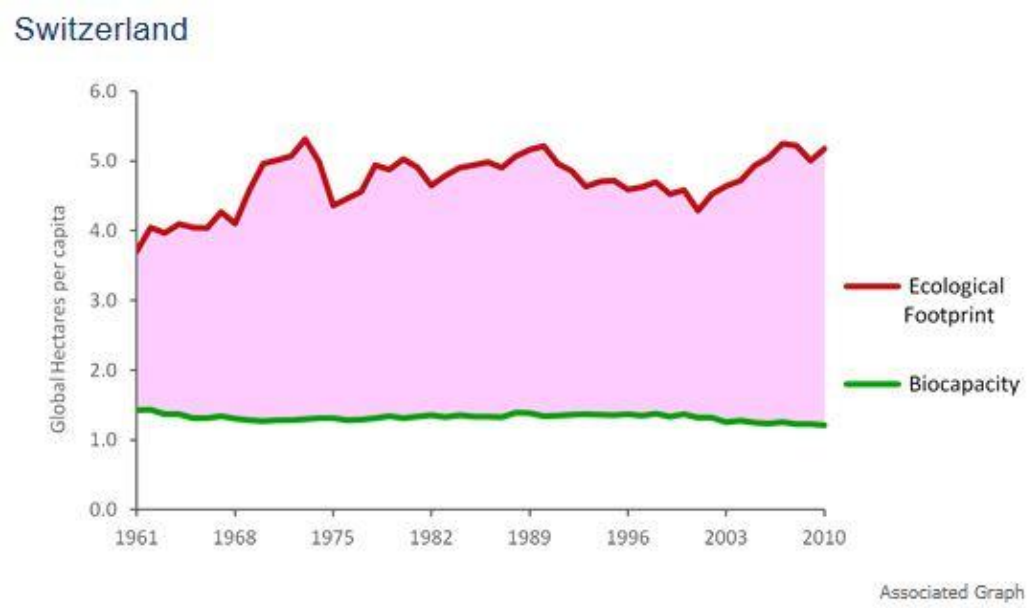


Fig. 16. Ecological Footprint of Switzerland compared to global biocapicity.[81] Due to the customs treaty and the common economic area with Switzerland it is assumed that the Swiss date above also applies to Liechtenstein.

By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.

In a densely settled country like Liechtenstein, land use planning is a crucial factor for the successful protection of biodiversity. Land use planning as municipal and national planning is executed in Liechtenstein via the Construction Act. [82] The 11 municipalities of Liechtenstein are responsible for communal planning, while the Government is responsible for transmunicipal and cross-border planning. Such planning must be undertaken in cooperation with the municipalities. In addition to the legal requirements, the basis for land use planning is made up of master plans and construction codes with zoning plans. The zoning plans include construction zones as well as agricultural and protection zones as the most important zones.

According to the governmental Spatial Planning Report an increasing extension of settlement areas can be observed (Fig. 17). The report outlines the situation of land use planning and spatial development in Liechtenstein as well as the need for action.[83]

[81] www.footprintnetwork.org - as of July 2014

[82] Baugesetz (BauG), LGBl. 2009 Nr. 44

[83] Regierung FL (2012). Raumordnungsbericht 2012

The large and largely-developed construction zones offer space for about 70’000 to 100’000 people with a current population of 37’000. The generous designation of construction zones has led to spread-out settlements, resulting in sprawling and costly infrastructure facilities and a high level of private transport.

It is envisaged to stop this trend by implementing different instruments. The National Master Plan for instance should provide a frame for national land use planning. Requests for reclassification of building areas need to prove a respective demand and the urbanisation programme Werdenberg-Liechtenstein requires the introduction of clear borders for settlement areas as well an increased density of settlements.

A positive assessment can be given to the increase in quality and quantity of the Liechtenstein forest as habitat. This is shown by the latest Forest Inventory from 2010, where it is observed that the current rate of annual forest use is under the rate of annual forest regeneration. [84]

Regarding degradation and fragmentation of habitats no studies for Liechtenstein have been concluded so far. Due to the high level of scattered urbanisation together with a corresponding infrastructure and a high share of motorized individual traffic it is assumed that Liechtenstein’s valley area can be qualified as highly fragmented. The trend to further fragmentation remains strong in the valley area. In 2013 a new connection road to an industrial zone was built. Further connection streets and new cycle tracks are planned. The abovementioned target will most likely not be achieved throughout the whole country by 2020.

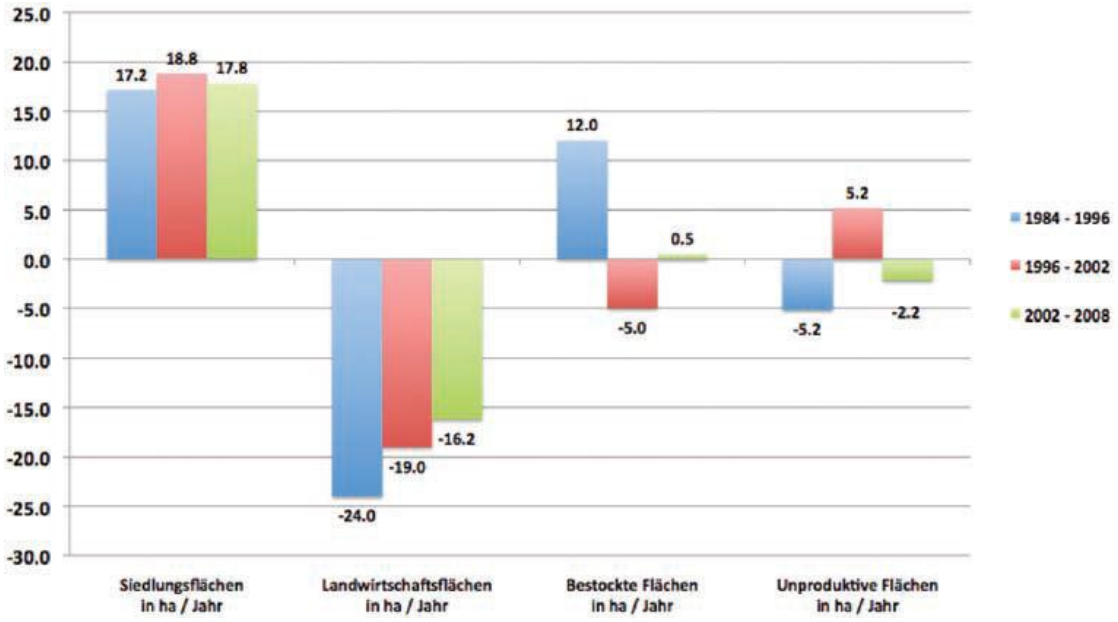


Abb. 17. Arealstatistik 1984-2008.[85]

[84] Office of Forests, Nature and Land Management (2012), National Forest Inventory 2010

[85] Bundesamt für Statistik (2008) – Arealstatistik Fürstentum Liechtenstein 1984-1996-2002-2008

By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.

Not the overfishing of local waters is considered to be the reason why more than half of all local fish species in Liechtenstein have been put on the Red List. The main reason for the disappointing status of local fish species as well as for water plants are the ecomorphological impacts on these waters. The affected waters will be subsequently revitalized depending on the availability of financial means. Regarding the legal situation with respect to the use of water-dependent organisms like fishes or crayfishes no further action is currently required. The existing Act on Fisheries including its ordinances provides rest zones and rest periods for endangered species. For some species like the crayfish a strict fishing prohibition applies. This Aichi target has therefore already been achieved.

By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.

As it has been described in the previous chapters on forests, agriculture and waters (1.4 – 1.6) all the areas that are used for forestry, agricultural or aquatic purposes are already managed in a sustainable way. Optimising potentials especially in the agricultural sector are constantly assessed and implemented where feasible. It seems therefore realistic that Liechtenstein will achieve this target.

By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.

As the results of chemical assessments of the Liechtenstein waters have shown (Fig. 13) the country's streams are poorly loaded with nutrients. Along these waters the use of fertilizers or herbicides is prohibited. Within the last years only very few incidents of water pollution occurred.

The quality target with respect to the concentration of nitrates in Liechtenstein's groundwater (Fig. 18) is regularly met only at one measuring station. Nitrate is considered to be the most important undesirable additive of drinking water. Nitrate is used as fertilizer within the agricultural sector as well as on green fields in settlement areas. Since plants are not capable to absorb the entire nitrate the water-soluble nitrates end up in the ground water. The concentration of nitrate in the ground water serves as indicator for water quality since ground water with high nitrate concentration would most likely be loaded with other harmful substances as well.

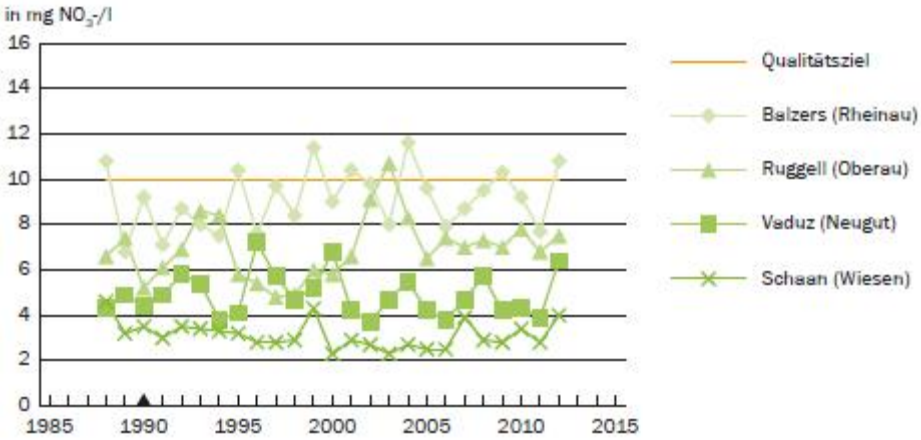


Fig. 18. Concentration of nitrate in ground water; annual peaks of four measuring stations.[86]

A positive trend has been observed with regard to air quality development. The concentrations of nitrogen, ozone and particulate matter decreased within the last years (Fig. 19)

Nitro oxides (NOx) are formed during combustion processes. Main sources to that respect are the transportation sector and fossil fuel based heating systems of buildings. Nitro oxide becomes ground-level ozone under the influence of sunlight. In addition to that nitro oxides contribute to the formation of fine dust particles and acids. The acids occure within so called acid rains which causes soil acidification. Nitro oxides are also harmful to human health.

Abb. 19. Development of the mean annual concentration of nitro oxides at 4 measurement installations.[87]

Ozone is a secondary pollutant which evolves under the influence of sunlight from nitro oxides (NOx) and volatile organic compounds (VOC). Ozone is the dominating element of summer smog. It is harmful to human health and to the environment.

[86] Office of Statistics (2014). Indikatoren für eine nachhaltige Entwicklung 2014

[87] Office of Statistics (2014). Indikatoren für eine nachhaltige Entwicklung 2014

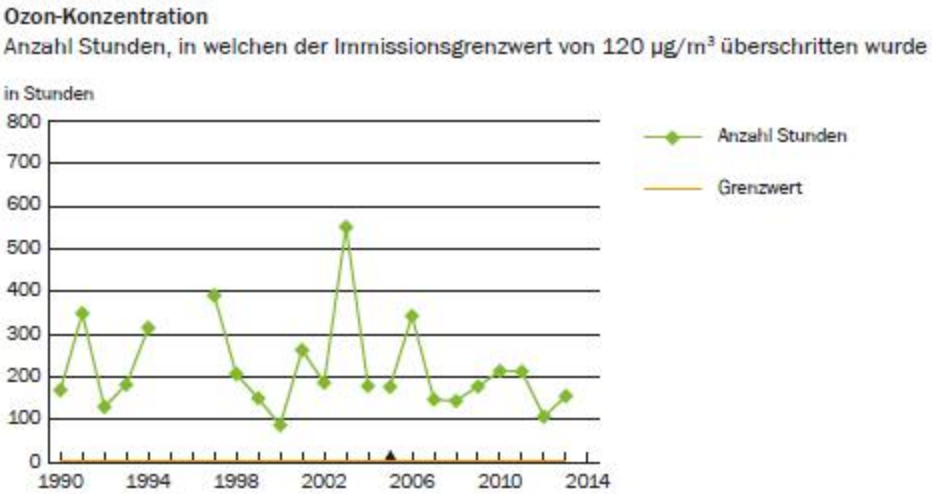


Fig. 20. Development of ozone concentration in µg/m^3.[88]

Numerous studies over the past years have shown that particulate matter in the air state a considerable risk for the human health (esp. increased cancer risk).

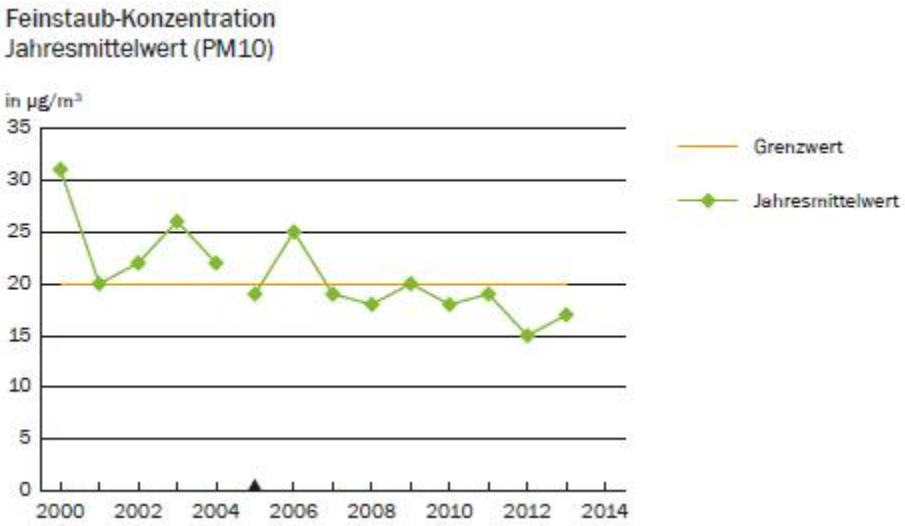


Fig. 21. Development of particle matter in µg/m^3.[89]

With exemption of the ozone levels all indicators remain under the thresholds showing a further downward trend. Hence, it can be assumed that Liechtenstein may achieve its target until 2020.

By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.

Due to the commissioning of the new web based neophyte GIS in 2013 the pathways of the invasive plant species became visible. The assessment showed that the stock of undesired species was especially high along the railroad tracks. The responsible railway company the „Österreichische Bundesbahn“ is aware of

[88] Office of Statistics (2014). Indikatoren für eine nachhaltige Entwicklung 2014

[89] Office of Statistics (2014). Indikatoren für eine nachhaltige Entwicklung 2014

that problem but does not have the human and financial resources to address the problem in an adequate way along the whole railroad track system. Regarding the distribution of neophyte by local gardening centres a sale prohibition of the most problematic species applies. With respect to other invasive species the Government has recommended the traders to refrain from selling.

In cases where traders do not follow this recommendations it is the obligation of the salesman to inform buyers about the appropriate handling of invasive (gardening) plants in order to avoid their further spreading in local habitats.

Plant species that received a priority classification have been actively fought for years now. The ragweed Ambrosia (Ambrosia artemisiifolia) for instance was successfully removed completely from habitats in Liechtenstein.

Other species like the goldenrod (*Solidago sp.*) are fought especially in nature protected areas. First optical assessments lead to the assumptions that these measures were successful. No monitoring system in Liechtenstein has been set up for neozooen and neomyceten (invasive animals) yet. According to nature biological studies it was at least recorded which foreign species may occur in Liechtenstein. These animal species are currently not actively fought but their level of spreading as well as their damaging potential is carefully observed.

In summary it can be concluded that Liechtenstein may achieve main parts of its target. A complete control or even elimination of all invasive species with a priority classification seems, however, not realistic.

By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.

As a landlocked country Liechtenstein is not directly affected by anthropogenic pressures on coral reefs or ocean acidification. Liechtenstein is, however, affected by climate change in other ways. For instance the stock of alpine plants moves on higher grounds, local wetlands are more and more threatened to dry and the risk of invasive plant settlements constantly rises. To address these risks Liechtenstein is currently developing a national adaptation strategy on climate change, including a respective action plan.

By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.

Around 12.3% of the country's territory is currently designated as areas with high value for biodiversity and ecological services (Tab. 5). These areas do not encompass the legally protected wild animal zones since the applicable ordinances are currently under review. The existing protected zones will most likely be reduced compared to today.

Also not considered are the sites of rough pasture habitats since the respective inventory is currently under review as well.

If these areas are considered at a later stage it can be assumed that Liechtenstein will achieve the abovementioned target until 2020.

Table 5. List of designated areas under protection in Liechtenstein compared to territory

Designated Areas under protection	Size (ha)	% of country's territory
nature protected area	175.9	1.0
protected landscapes	64.4	0.4
protected forests	1'747.8	10.8
Total	**1'988.1**	**12.2**

By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.

Due to the small size of the country as well as the specific climate-related and geological circumstances it is not possible to establish Red Lists for all animal and plant species according to the IUCN criteria. Is a specific species really endangered or simply hard to find because of its rare occurrence for instance at the margins of its common habitat? Nevertheless, Liechtenstein manages regionally adjusted Red Lists for breeding birds, reptiles, amphibians, fishes, crayfishes and fern and flowering plants (Fig. 22).

In order to achieve this target Liechtenstein will have to put further areas under protection, upgrade more natural habitats, avoid the destruction of living environments, stop the ongoing scattered urbanization, fight the spreading of invasive species and needs to react adequately to the effects of climate change. Since Liechtenstein's influence on global problems like the spreading of invasive species or global warming is very limited it is more than doubtful that the above-mentioned target may be achieved until 2020.

	Nachgewiesene Arten	Einheimische Arten	Arten der Roten Liste nach IUCN-Kategorie				Artenschutz	
			In Liechtenstein ausgestorben	Vom Aussterben bedroht	Stark gefährdet	Verletzlich	National	International
Artengruppe			(RE)	(CR)	(EN)	(VU)		
Säugetiere	70	67	*	*	*	*	35	52
Brutvögel	134	131	18	18	13	13	117	131
Reptilien	7	6	-	-	2	2	6	6
Amphibien	9	8	1	1	2	2	8	8
Fische	27	24	-	-	4	13	-	4
Weichtiere	122	120	*	*	*	*	-	1
Krebstiere	2	2	1	-	2	-	-	2
Farn- und Blütenpflanzen	1 475	1 391	56	68	61	110	96	98
Moose	440	439	*	*	*	*	-	1
Pilze	1 705	1 702	*	*	*	*	-	-

Fig. 22. List of endangered species in Liechtenstein and their status according to IUCN.[90]

[90] Office of Statistics (2012). Umweltstatistik 2012

By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.

In the field of promoting genetic diversity, Liechtenstein has supported the project "Conservation of the Genetic Diversity of Cultivated Plants in the Principality of Liechtenstein" since 2001. Dedicated inventories have been compiled for fruit varieties, grapevines, vegetable varieties, and specifically for "Rhine Valley corn", a regional corn variety. Since Liechtenstein is not a closed region with respect to the use of cultivated plans, but rather is part of the Lake Constance-Alpine Rhine region, regional cooperation is of particular importance. From 2004 to 2008, Liechtenstein participated in an Interreg project on the protection of pomaceous fruit varieties in the Lake Constance region. In addition to variety-specific orchards and conservatory planting of seeds, cooperation exists with the Swiss GenBank for the storage of seeds. The HORTUS association serves as a platform for coordinating the necessary activities.

With respect to organisms in the wild, measures exist for the conservation of genetic diversity primarily in the forests. With the goal of conserving the genetic diversity of local races of tree species used in forestry, the natural regeneration of the forest is preferred to planting. Where planting becomes necessary, the State of Liechtenstein ensures a supply of local seeds for the forests by operating a forestry seedling nursery. Additionally, the forest reserves help conserve the genetic reservoir.

By continuing these measures Liechtenstein will most likely achieve the above-mentioned target.

By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.

Another important element of sustainable development is to limit the use of natural resources under the respective level of regeneration. In addition to that an environmental friendly consummation of goods should be enabled. The most important natural resource of Liechtenstein is its drinking water. Until today there is sufficient drinking water stored and available in Liechtenstein. However, considering an ongoing climate change the use of drinking water needs to be further reduced. The daily per capita use of drinking water (including industry and service sector) declined since 1991. In 2012 the daily per capita use of drinking water was 840 litres. In 1991 the daily per capita use of drinking water was 1’078 litres (Fig. 23).

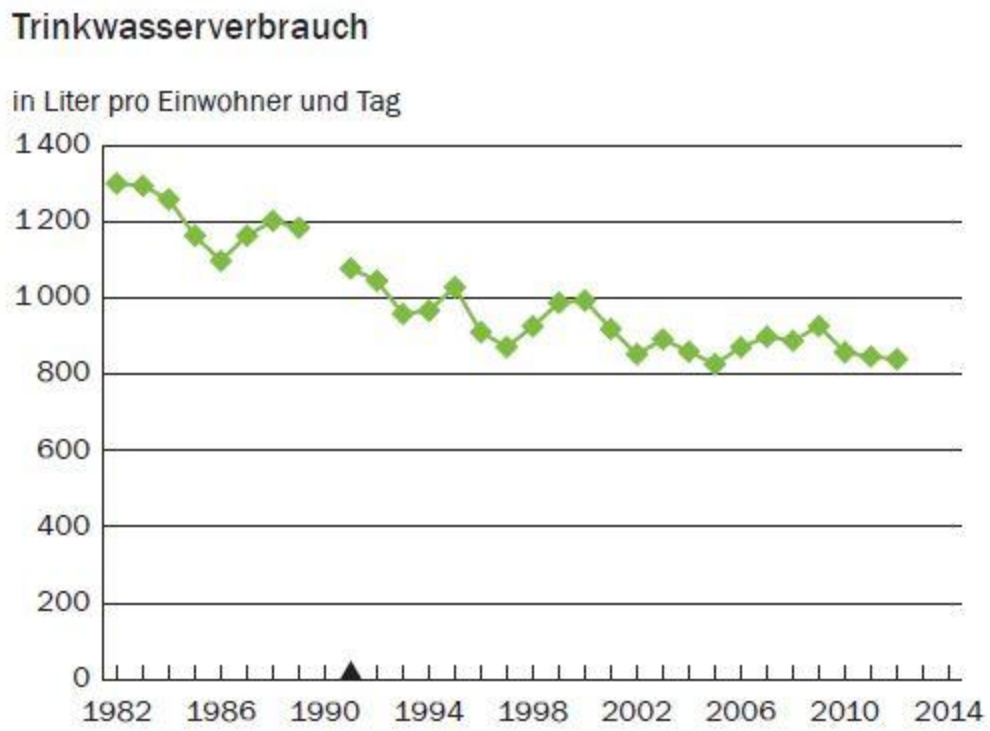


Fig. 23. Development of drinking water use since 1982.[91]

One core measure for the protection of drinking water is the designation of drinking water protected areas. Besides the already existing areas Liechtenstein will allocate a further protection status to a new area in 2015.

Another very important ecosystem is the Liechtenstein forest. Forests purify drinking water, produce oxygen, regulate the local climate and serve as protection shields for settlement areas against natural disasters (mudflows, avalanches). As described in chapter 1.4 the problems of the forests have been identified and have been addressed accordingly. It will be, however, not possible to restore the complete forest related ecosystem since the regeneration of woods will take a longer time horizon. The target will therefore not be completely achieved.

By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.

Figure 24 shows the trend of CO_2 sinks and sources within the sector of land use and forests since the base year 1990. The increase of biological matter serves as CO_2 sink whereas dying forests, the harvesting of forest biomass and the loss of natural soil are qualified as CO_2 source. The respective monitoring data come from the national greenhouse gas inventory which is updated annually by the Office of Environment for compliance reasons under the UN Framework Convention on Climate Change and the Kyoto Protocol.

[91] Office of Statistics (2014). Indikatoren für eine nachhaltige Entwicklung 2014

Since the increase of biomass in forests over the past years was higher than the loss of biomass and the organic soils do not cause any relevant emissions the overall qualification of Liechtenstein's ecosystem as CO_2 sink can be assumed (Fig. 25).

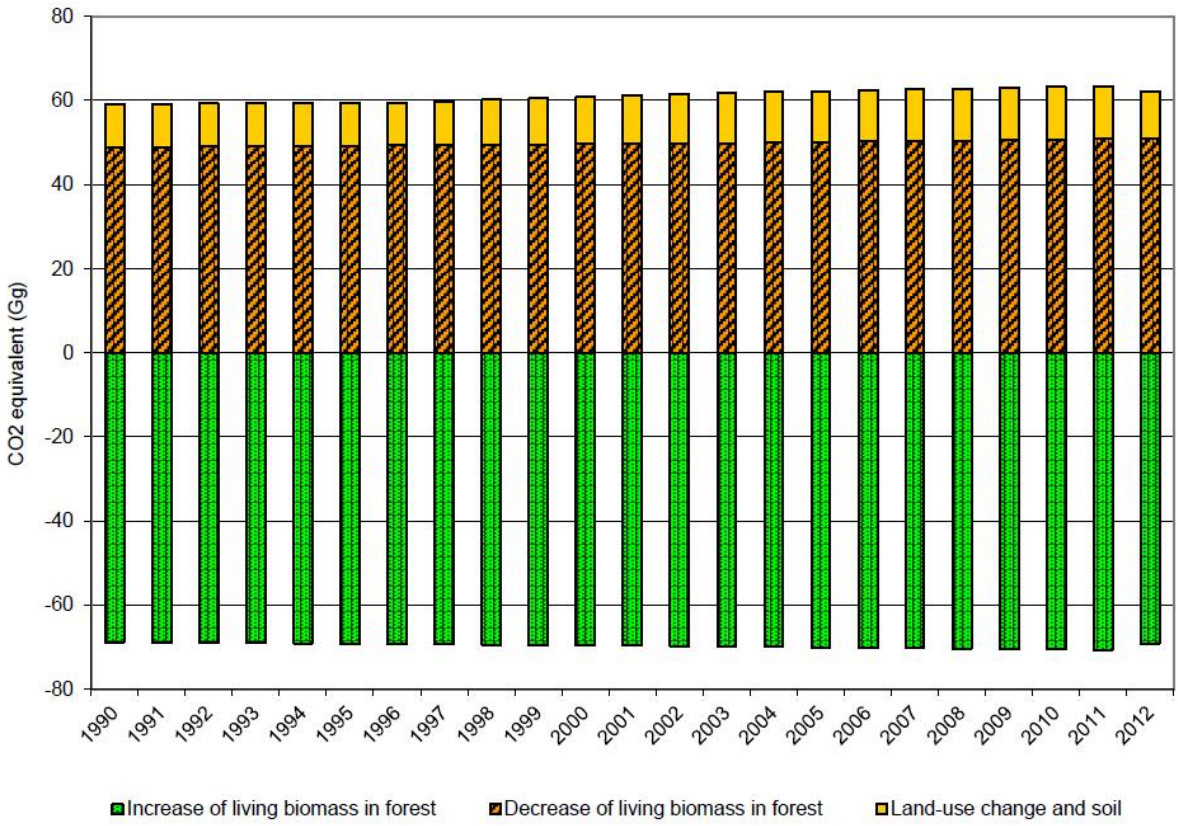


Abb. 24. Trends of CO_2 sinks and sources since 1990.[92]

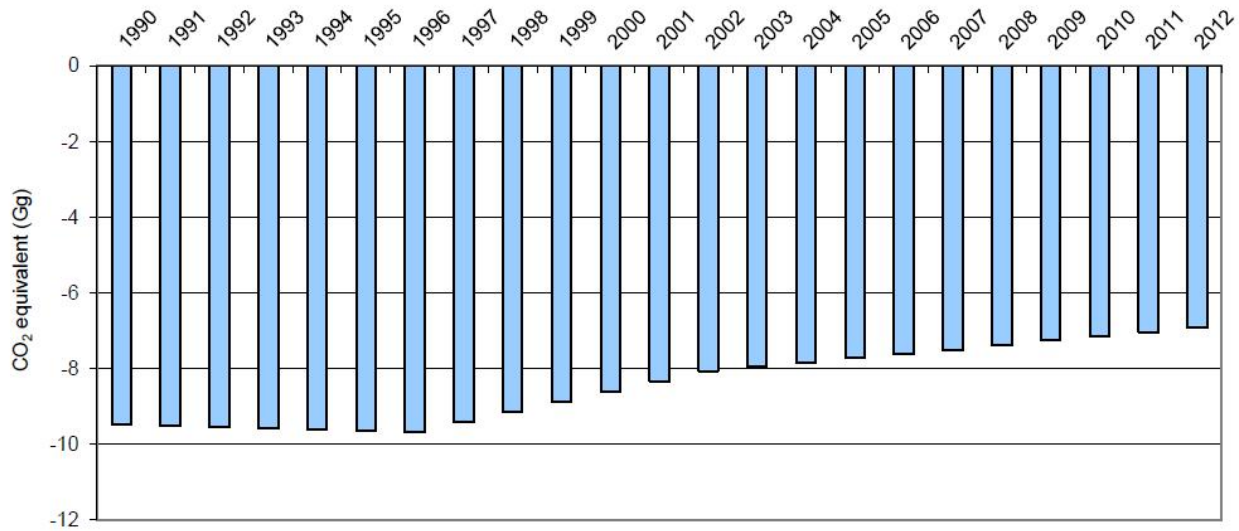


Fig. 25. Net CO_2-storage by forests and organic soils since 1990.[93]

[92] Office of Environment (2014). National Greenhouse Gas Inventory 2014

[93] Office of Environment (2014). National Greenhouse Gas Inventory 2014

Relevant ecosystems for the storage of greenhouse gases in Liechtenstein are the flat moorlands. The comparison of the vegetation mapping of the biggest flat moorlands the "Ruggeller Riet" and the "Schwabbrünnen-Äscher" showed a shift of plant communities over the past 20 years. The respective results lead to the assumption that a loss of moorland area took place and that these moorlands suffer from a lack of nutrients from the air as well as from missing buffer zones, that invasive species have spread (esp. *Solidago sp.*) and that the overall water level is sinking. Especially the latter observation is worrying with respect to the CO_2 storage capacities of the moorlands. The reasons for that are most likely a low groundwater level and the effects of climate change. The growing scrub vegetation in moorlands also contributes to this effect since bushes absorb more water from these areas.[94]

Liechtenstein has identified these problems and has to some extend already launches adequate counter measures. The revitalisation of waters for instance contributes to a rising groundwater level. The problems are, however, multilayered and complex. Much time as well as considerable financial means is needed to address these problems properly. It is thus unlikely that Liechtenstein will completely achieve the target by 2020.

By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.

Liechtenstein has not yet ratified the Nagoya Protocol but it is intended to so. The target will be achieved until 2015.

By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.

As shown in chapter 2 Liechtenstein already has a national biodiversity strategy as well as a corresponding action plan in place. The implementation of the strategy and action plan started in 2010 the UN Year of Biodiversity. The target has thus been already achieved.

By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.

[94] Office of Environment (2013). Die Magerstandorte Liechtensteins

Liechtenstein has no indigenous people or communities as defined by the convention. The management of relatively inaccessible areas which are used as extensive fields for late autumn cuts may however be considered as important impact indicator to Liechtenstein's biodiversity. Rough pastures traditionally belong to the country's biodiversity hotspots; there conservation is financially supported and they enjoy legal protection. Liechtenstein will therefore achieve this target by 2020.

By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.

The Institute of Architecture and Planning at the University of Liechtenstein does research on sustainable development. The Institute is participating in the project "Alpine Rhine Valley: Future Concepts for Settlement, Nature and Networking". The Institute does not carry out research work on ecology and species. Nature research is carried out by the Office of Environment on behalf of the Government, in close cooperation with private nature protection organizations. All publications of these research studies are digitally available on the website of the Office of Environment.

Liechtenstein supports research activities abroad by making an annual contribution of CHF 250,000 each to Switzerland (Swiss National Science Foundation, SNSF) and Austria (Austrian Science Fund, FWF).[95] As an EEA member, Liechtenstein also participates in the 7th Framework Programme for Research and Technological Development, which ran from 2007 to 2013.

The Government also participates at the program "Interreg". This is a promotion program of the European Union for cross-border cooperation that is financed by the European Fund for Regional Development (EFRD). Interreg aims to promote a balanced development in cross-border regions, thus making a contribution to European integration. The new program Interreg IV runs from 2007 to 2015. Liechtenstein is part of the promotion region "Alpine Rhine-Lake Constance-High Rhine" in the Interreg IV A program (www.interreg.org).

On the basis of joint strategies for sustainable spatial development, the program promotes the creation of cross-border economic and social "poles". One of the thematic focuses is the preservation of natural resources and cultural heritage.

In summary it must be stated that Liechtenstein due to its small size conducts very little internationally relevant research within the areas of biodiversity. Nevertheless, Liechtenstein contributes financial means to relevant international cross-border research activities. The target will therefore be achieved by 2020.

By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.

[95] Liechtenstein Government (2014). Rechenschaftsbericht 2013

This target will most likely not be achieved by Liechtenstein. Since 2009 Liechtenstein has to go through a process of budgetary consolidation in order fix its national budget. Several austerity measures have been launched ever since which lead to budget cuts in all administrative areas. Consequently no financial means are currently available for further revitalization of stream waters. Human resource capacities within the area of environmental and nature protection have also been cut back. It is currently unlikely that additional financial means for the implementation of the strategic plan will be granted in the near future.

3.3 Millenium Development Goals

The Millennium Development Goals of the United Nations, MDG consist of eight development goals for 2015 and have been formulated by representatives of the United Nations, Worldbank, the IMF and the Development Assistance Committee of the OECD. These goals followed the adoption of the UN Millennium Declaration which has been passed during the Millennium Summit of the UN in 2000. Goals 1 to 7 require developing countries to ensure that financial means are used for poverty alleviation, the fight against corruption, for ensuring gender balance and to support democratic processes. Goal 8 requires developed countries to use their economic powers to develop a global partnership for all countries in the world. In this context goal 8 requires Liechtenstein to provide the respective development assistance.

Official development assistance (ODA) encompasses all disbursements of a State for development cooperation and humanitarian assistance according to the criteria of the Organisation for Economic Cooperation and Development (OECD). To compare ODA among States, an indicator is commonly used to measure ODA as a percentage of gross national income (GNI) of a given State. The international ODA target is 0.7%.

The Liechtenstein Government has repeatedly underscored its commitment to achieving this target as soon as possible. The currently available ODA percentage for 2011 is 0.69. The total ODA amount, which includes the disaster fund of the municipalities and care for asylum-seekers in Liechtenstein, was CHF 26.2 (Fig. 25).

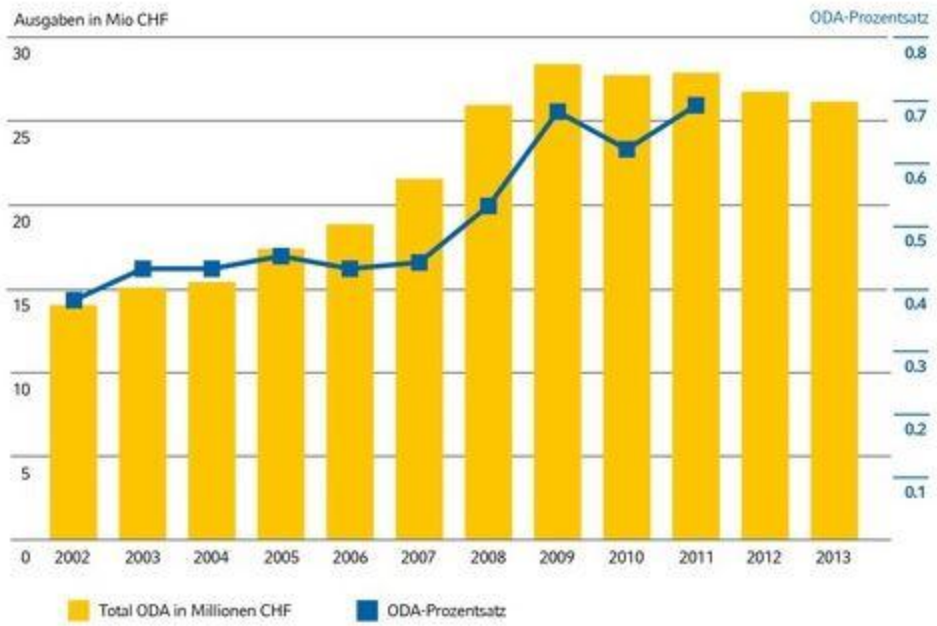


Fig. 25. Development of Liechtenstein's ODA-percentages from 2002-2011.[96]

[96] http://www.llv.li/#/1293/offizielle-entwicklungszusammenarbeit-oda - Stand Juli 2014

3.4 Conclusiones

The Convention on Biological Diversity has strengthened the protection and sustainable use of biodiversity in Liechtenstein. The Convention represents global goals and principles that can also serve as guideposts at the regional level. This process of translating global goals into locally implementable, operational goals is currently underway in Liechtenstein. The Biodiversity Convention has put concepts such as sustainable use, the precautionary principle, the ecosystem approach, and ecosystem services on the political agenda. It has also contributed to expanding the focus from species diversity to include genetic diversity and ecosystem diversity.

Liechtenstein will not achieve all measures defined in its National Action Plan 2020 and will most likely not be able to meet all Aichi targets. The assessment within this report underlined, however, that several sub targets have already been achieved and that other targets will be achieved within the given timeframe. Although an overarching sustainable use of biodiversity until 2020 will not be achieved the respective process towards that direction to get there has obviously started.

This has been proven by the measures within the biggest relevant areas forests and agriculture which have been already listed in the 4th CBD Report. The whole forest area has been certified according to the FSC criteria and within the agricultural sector the share of ecologically managed fields is growing slowly but surely. On one hand the 5th Report showed numerous positive developments as for instance the designation of new nature protection areas or the implementation of a strategy to fight invasive species.

On the other hand several problematic issues remain to be solved. During the past years new challenges (such as climate change, invasive species) as well as new planning and steering requirements (strategies, action plans, implementation of EEA provisions, new international agreements) had to be addressed within the area of environmental protection.

Addressing these challenges will be difficult considering the current budgetary cuts and a reduction in personal capacities within the competent authorities. Another field of growing conflicts potential is the area of land use planning. Due to limited space in Liechtenstein it will be unavoidable to establish certain priorities in order to reflect the political will as well as the will of the Liechtenstein population in relation to the diverging interests of settlement areas, agriculture and the protection of nature and waters.

Annex I: Information on the State Party and preparation of the report

State Party

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Unterschrift des Verantwortlichen für den Nationalen Bericht	
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