

GERMANY



1. Land Use

Germany is situated in the centre of Europe and covers an area of $3.5697 \times 10^5 \text{ km}^2$. With a population of about 8.2×10^7 , the average population density is about 230 inhabitants/ km^2 . In spite of the dense population and the high level of industrialisation, 54.1 % of the German territory is farmland and 29.4 % woodland. 11.3 % of the area is used for settlement and transportation systems.

2. Landscapes

A rough subdivision of Germany by landscapes shows three basic forms: the North German Plain, the uplands and the Alpine region. The North German Plain consists of hilly geest and moraine landscapes with many lakes as well as lowlands and glacial meltwater channels. Areas of moorland and heath are especially found in the north-west. The hills of the central uplands separate North Germany from South Germany. The uplands are morphologically subdivided into mountainous regions and valleys, the mountains reach altitudes from 700 to 1,500 m. The Alpine region is subdivided into the South German Alpine Foreland and the Bavarian High Alps in the south with the highest German mountain, the Zugspitze, reaching a height of 2,962 m above mean sea level (msl).

3. Climate

The climate of Germany is governed by the humid temperate climatic zone. The mean annual precipitation is about 770 mm, varying from the lowest mean of 500 mm p.a. and the highest in the Alps of about 2,500 mm p.a.. In general, precipitation decreases from west to east.

4. Surface waters

The surface waters include six river systems, i.e. the Rhine, Ems, Weser and Elb draining into the North Sea, the Odra draining into the Baltic Sea and the Danube discharging into the Black Sea. The rivers are connected by various canals. All rivers carry water throughout the year with varying discharges depending upon precipitation, season and groundwater level.

Natural lakes are mainly found in the North German Plain and in the Alpine Foreland. They cover a total area of $1.213 \times 10^3 \text{ km}^2$. Twenty six of the natural lakes have a surface area of 10 km^2 each. The largest lake is the Bodensee (Lake Constance). Additionally, there are numerous artificial reservoirs in Germany with a total capacity of $2.985 \times 10^9 \text{ m}^3$ of water.

In Germany monitoring of water resources is undertaken to secure existing and possible future drinking water supplies and to protect aquatic ecosystems. Although both biological and chemical monitoring is undertaken to provide an indication of overall water quality, water classification is based solely on a saprobic (biological) index system. The eight quality classes are defined as:

- Quality Class I : No or very little pollution
- Quality Class I to II : Little pollution
- Quality Class II : Moderate pollution
- Quality Class II to III : Critical pollution
- Quality Class III : Heavy pollution
- Quality Class III to IV : Very heavy pollution
- Quality Class IV : Excessively polluted
- Quality Class V : Ecologically destroyed

Monitoring for the purpose of national classification is carried out by the Länder at 146 sites throughout Germany.

The long-term objective in Germany is to ensure that all waters attain at least Class II status. To a large extent this has been achieved in the west of the country, however, in the east there are still extensive problems in particular that are due to inadequate treatment of sewage, a legacy of the previous regime.

5. Groundwater

The groundwater has important ecological functions. Its natural quality must be preserved and protected throughout the country. The goals of groundwater quality must be oriented on the quality of natural groundwater- pollution must be eliminated. Polluted groundwater mean long-term damage, which can be eliminated only over a long period and with considerable technical and financial effort. For this reason, groundwater must be protected against harmful inputs of substances by means of preventive measures. To achieve this goal the soil must also be sufficiently protected with the objective of minimising the input of problem substances in terms of quantity and quality from industry, trade, transport, agriculture and households.

The quality of groundwater resources is also monitored in Germany. There is significant concern in the country about deterioration of groundwater resources, not least because of their importance as a source of drinking water.

6. Water demand satisfied by surface waters and groundwater

The annual volume of water used in Germany (data of 1995) is $4.52 \times 10^{10} \text{ m}^3$, the greatest share of which (approx. $2.78 \times 10^{10} \text{ m}^3$) was used as cooling water by thermal power stations supplying the public. The industrial sector consumed roughly $1 \times 10^{10} \text{ m}^3$, and approx. $5.8 \times 10^6 \text{ m}^3$ was used for public water supplies. Mainly groundwater and spring water (72.7 %) is used for public water supplies, followed by surface water (22 %) and bank-filtered water (5.3 %). Roughly $1 \times 10^9 \text{ m}^3$ per year were used by the

agricultural sector. In total, there are $1.61 \times 10^{11} \text{ m}^3$ of water p.a. available on average. Nevertheless, in the south-west and the central eastern parts of Germany, long distance water transfer networks are required to supply population centres in these areas.

Germany has succeeded since the 1970s to uncouple water consumption from general economic development. Between 1970 and 1990 water taken by industry from public supplies decreased by about one third. The water productivity of the economy as a whole has thus increased. This is also true for the per capita consumption of households, small businesses and the agricultural sector.

Two components can be discerned: first, the prevention of pollution by way of advanced water treatment; and second, the multiple use and reuse of (protected or treated) water within industrial plants. The "minimisation approach" trend will continue to be promoted as shown by the laws already in force and by current policy initiatives. In addition, there is an identifiable shift in industrial water use from groundwater to surface water.

A further trend concerns the sealing of the ground which reduces groundwater recharge and increases the risk of flooding. Increasingly, municipalities are beginning to finance the treatment of rainwater run-off through a charge based on the area of sealed surfaces. This creates an incentive to cover suitable surfaces with porous stones or to infiltrate the flow from sealed surfaces rather than feed it into sewers.

7. Agriculture

The overall task of German agricultural activities today is :

- sufficient food production at reasonable prices;
- public supply with excellent food quality for the consumer's health; and
- safeguarding a sustainable and resilient environment as well as preserving the cultural landscapes.

The objective of agricultural irrigation in the humid climate sector, to which Germany belongs, is to compensate individual cases of precipitation deficits during the vegetation period with artificial water supplies in order not to improve but to save crops and their quality. In Germany, irrigation is applied to areas of intensive agricultural and horticultural activities with annual precipitation rates of less than 700 mm. It is estimated that about 5.31×10^5 ha of land, i.e. 3 % of the agricultural acreage, are irrigated. The irrigation methods employed are mainly sprinkler systems, for which generally groundwater is extracted.

In the future, the irrigated area will not steadily increase. Sprinkling will mainly be applied to special crops including vegetables and potatoes, because it guarantees great irrigation economy.

8. Legal structure

The political constitution of Germany is ruled by a federal system, i.e. public functions are partly assumed by the Federal Government and partly by the 16 L nder. According to the Basic Law, i.e. the constitution of the Federal Republic of Germany, the communities (towns, districts and municipalities) are part of the respective Land. However, in dealing with local matters, the communities can act to a certain extent on their own responsibility (right of self-government) under constitutional law. Federalism and the application of the subsidiarity principle are the most prominent features of water management institutions in Germany. The overall framework for water resource protection, planning, and management is therefore characterised by the fact that there are three primary levels of competence in addition to the European Union: Federal Republic, L nder, and municipalities. Since 1960 the Federal Government provides a legal framework for all L nder with the Federal Water Act. The L nder themselves have complemented the Act by issuing specific L nder Water Laws, which are legally binding upon all water users.

The principles of federalism are thus applied to water management in a flexible way, allowing decisions to be taken by water users themselves or at the municipal, local or L nder level, in the various professional communities, in the private or in the public sector, whichever is most appropriate. The principle of

subsidiarity is thus applied throughout the structures of state government, municipal affairs and the allocation of tasks to the public and private sector, e.g. agriculture.

9. Associations

In addition, water management associations can be formed by land owners, private enterprises, municipalities and public corporations for a wide variety of functions. Corresponding to local and regional needs, these associations can be small neighbourhood schemes in rural areas or cover a large territory. They are based on the principle of user participation and local autonomy. The L nder have established the legal framework for associations to operate irrespective of any territorial boundaries that might otherwise hinder water management according to hydrological criteria. The Federal Government therefore has enacted the Water and Soil Act for the organisational structure of such associations. These operators of water infrastructure systems are not involved in the manufacturing or service sectors associated with the "water industry" (this term is not used in Germany).

10. Technical-scientific associations

The following technical-scientific associations are concerned with the objectives of water resources management :

- The German Association for the Water Environment, ATV;
- The German Institute of Standardisation, represented by the Technical Committee on Water Management, DIN/NAW;
- The German Gas and Water Association, DVGW and
- The German Association for Water Resources and Land Improvement, DVWK.

The ICID National Committee of Germany is organisationally connected to the DVWK.

11. Water management in Germany

Long-term objectives of the German water resources policy is based on the principles of:

- priority of prevention;
- cooperation of all parties concerned;
- allocation of costs on the basis of the polluter-pays principle and full coverage of costs with tasks performed on the basis of subsidiarity and decentralisation.

These objectives are supported by a lot of tools. One tool is water management planning. It serves to secure social and economic development in the long term. It applies to water management as well as to water resource protection which is a necessary precondition for sustainable development. The instruments for general water management planning are water management framework plans and water management plans. Water management plans aim at the protection of surface water bodies rather than quantitative water management. For water resource protection the following instruments are used: effluent disposal plans, effluent load plans, surface water protection regulations and water protection zones; in addition, flood areas can be designated.

On the basis of comprehensive water resource protection Germany has developed a zoning approach which is increasingly being recognized as a model solution. The Federal Water Act provides for the establishment of water protection zones in order to :

- Protect water bodies from harmful effects in the interest of public water supply,
- Recharge underground aquifers, and
- Prevent pollution from run-off containing soil components, fertilisers and biocides.

Water protection zones must be identified in water management registers. Activities may be restricted or even banned in water protection zones and property owners are obliged to tolerate measures connected

with water protection, such as monitoring. These restrictions can be applied seasonally or year-around. Specific land uses can be imposed according to provisions in Land Water legislation. The precise restrictions are laid down for each protection zone through Länder legislation in the form of ordinances.

Another main tool is the requirement for a permit or licence for nearly all water uses. None has the right to a permit or licence but anyone can expect, by right, a proper decision on application. A permit can be granted temporarily, and it can be withdrawn at any point if this is justified on the grounds of water resource protection and management. A licence establishes the right to a specific water use which cannot normally be withdrawn. When issuing a licence, competent authorities have to take the rights and interests of other water users into account (in addition to the public interest). Established water quality requirements, often reflecting the need to maintain quality for specific uses, can justify denying a permit or licence.

A third economic instrument should be mentioned. In Germany, economic instruments are used to reduce the "implementation deficit" in environmental policy using direct regulations. Direct regulations and economic instruments (effluent charges and water resources taxes) are linked since the charges and taxes are levied, as a rule, only where an abstraction permit or licence is required and often not on the amount of water actually abstracted or pollution load discharge but rather on the quantity for which a permit has been granted. Finally, the taxes are usually set by the same public agencies that are also responsible for the granting of abstraction or discharge permits. From the administrative point of view, direct regulation and economic instruments are designed to work in tandem.

12. Water pollution due to agriculture

As further progress is made in waste water treatment, the main share of the pollutant load in water bodies in many cases is shifting to agriculture. Presently, approximately 50 - 55 % of all nitrogen and 40 - 45 % of all phosphorus inputs into German water bodies originate from farmland. There are no precise input data available on plant protection substances (pps), but global surveys show that only a few pps are detected throughout the year (e.g. atrazine, which has been banned since 1991).

Water pollution through farming is mainly caused by:

- erosion and rainwash of soil particles contaminating surface waters with phosphates and pps,
- leaching of nitrate as a result of the use of mineral fertilisers and farm manure of animal origin, and leaching of some pps into groundwater above detection limits, and
- direct discharges of fertilisers, semi-liquid and liquid manure, and residual liquors containing pps (which is not permitted).

The use of mineral fertilisers in intensive farming, which showed an increase until the late eighties, the large number of cattle involving a high amount of liquid manure and the increased application of pesticides over the past few decades have led to a greater pollution of waters, and groundwater in particular. A change of contamination has very often not been observed until today because of the long time lag between application and detection in the groundwater layers.

13. Environmentally sound agricultural practice

Counteracting this development requires that farming be adapted to an ecologically and socially sound structure. Already enacted are the Federal Water Act, the Fertilisers Act, and the Plant Protection Act as well as the EC Directive concerning the Approval and Application of Pesticides and the EC Directive concerning the Protection of Waters against Pollution through Nitrate from Agricultural Sources ("Nitrate Directive") being important legal provisions for an environmentally compatible agriculture.

Land use by agriculture, according to the rules of good professional practice, has to be introduced to minimise as much as possible the nutrient inputs into waters. Pesticides, if properly applied according to the provisions, must not have any harmful effect on ground and surface waters.

The farming community itself has long acknowledged the requirement of water protection and has recognized the considerable potential of practical improvements. The DVWK and other associations therefore have published a "Position Paper on the necessary political Initiative for Agriculture and Water Protection", and have presented this paper to the Federal Government for a reorientation of the Common Agricultural Policy and to establish a harmonised agricultural and environmental policy. The European Water Framework Directive, presently submitted to the Council of the European Union for negotiation and decision-making, will substantially influence water protection and practised land management.

14. Flood protection

Comprehensive inland flood protection measures, i.e. mainly the construction of dykes, but also retention basins and reservoirs, have considerably reduced the danger of flood damages in Germany.

The reduction of flood plains through dyke construction, the acceleration of flood waves as a result of river training, barrages and coincidences with the flood waves of the similarly developed tributaries have caused a substantial rise in flood peaks in large rivers. A reduction in the water retention capacity of the countryside, brought about by the expansion of settled areas, intensive farming, damage to forests in mountain regions and the training of small rivers has also contribute to intensified flood events. Severe flood damages of recent events appeared in late 1993 and early 1994 and in January/February 1995 on the river Rhine and in the summer 1997 in the Odra basin.

Existing protection systems must be maintained and developed in accordance with the state of the art. The stability of flood protection facilities (reservoirs, retention basins, dyke systems, flood spillways) must be maintained, and if necessary improved through continuous inspection.

Future measures will put emphasis on the conservation and reconstruction of natural flood plains (e.g. riparian forests) and on the conservation or restoration of rivers and lakes. Flood plains have to be allocated, where structural changes and any kind of use with adverse effects will be prohibited.

In addition, a great variety of measures of minor importance must be implemented to support the retention, infiltration and retardation of precipitation run-off from developed areas and farmland. Also needed are measures which, in combination, can mitigate floods in smaller rivers. Such measures include, for example, soil-conserving practices in agriculture and forestry, unsealing of land surfaces and stormwater retention measures. Flood protection on the coast is also a major task in the five "coastal" L nder, in order to protect 1.1×10^5 ha of agricultural lowland which can be flooded through storm surges if no precautionary measures are applied.

15. Rural Development

The overall societal framework conditions for rural areas are changing rapidly at national and international levels. Among the highlights are the reunification of Germany, the EU enlargement to include Eastern European countries, the globalisation of world markets, the continuing development of the EU's structural policy, a continuing change in agricultural structures as well as the establishment of the sustainability principle for regional development. Against this backdrop, rural development must face up to great challenges. These include:

- supporting agriculture and forestry,
- promoting regional and community development, and
- securing durable conservation of natural life-support systems.

Buttressing the economic strength of rural areas and securing and creating jobs are the decisive factors for the development of rural areas. This requires:

- efficient and competitive, market-oriented and environmentally sound agriculture and forestry sectors,
- job alternatives outside the agriculture and forestry sectors,
- an efficient and demand-driven infrastructure (transport, supply and disposal, telecommunications,

- education, cultural and social affairs),
- an attractive living environment, and
- a healthy environment, leisure activities and a high cultural standard.

It is becoming increasingly clear that those regions can best face up to transformed framework conditions, which develop self-sustaining economic and financial cycles. They are particularly important for agriculture and forestry, as they play a vital role in coping with changing agricultural structures.

Agriculture and forestry still are important sectors of the economy in rural areas. As they fulfil manifold area-related tasks they are of fundamental importance for the whole of society. Agriculture and forestry are the only economic sectors securing the management, preservation and development of the cultural landscape as a whole. Aiming at promoting competitiveness of agricultural and forestry enterprises and advancing their active and smooth integration into a sustainable regional and community development, rural development instruments are to be used as follows :

- A foresighted land and soil management must prevent conflicts in land use, which increasingly interfere with agricultural and forestry purposes. Existing land use conflicts must be settled.
- The development of holdings in the new Laender must be effectively accompanied by the determination and reorganisation of the location of property areas.
- Cultivated areas must be adapted to the economic requirements resulting from the continuing structural change in agriculture according to their location, form and size and must be developed by a suitable network of roads and water bodies. The participation of farmers and foresters in area-related promotion programmes must be supported in the restructuring process.
- Gains in productivity and time can free resources for non-agricultural activities and income alternatives. In addition to direct marketing, tourism and management measures in the framework of nature and landscape conservation, the provision of new services in the framework of village renewals must be facilitated. This can be done by converting the use of agricultural buildings, in particular for the purposes of living, commerce, trade, cultural activities or public and community life.

In order to improve site qualities and living conditions in rural areas the implementation of the following goals is a priority:

- High priority must be given to the protection of land ownership. Settling competing claims for using and determining the location of property means creating legal certainty, using private capital and thus promoting public and private investment.
- Providing land for infrastructure projects and building sites at attractive locations facilitates the establishment of service, craft and trade industries.
- Support must be given to the design of a rural infrastructure which is tailored to needs.
- A sustainable housing development with little land consumption must be promoted, for instance, by preserving characteristic village buildings through converting their use and renovating them.
- Community spirit, community life and village culture can be revitalised, for instance, by preserving or establishing community centres, village inns and village stores as well as by supporting social and cultural initiatives.
- Provision of areas for water retention and reducing the risk of erosion.
- Support of the protection of land and water and preserve drinking water reserves.
- Compensation and substitution measures at suitable locations in accordance with nature conservation legislation should be carried out.
- Special environmental protection programmes, for instance programmes concerning wetland meadows, riverbanks, statutory nature conservation and extension should be supported.
- Ecological assets to villages, for instance by designating green belts, planting greenery, unsealing surfaces and restoring water bodies should be added.
- Land management is one of the core competences of rural development. In the interest of a future-oriented rural development strategy it can be helpful in the following situations :
- in difficult, problematic cases of land reorganisation; planning and implementation are to be offered "as one". For instance in the case of big infrastructure projects, recultivation of landscapes

- characterised by open-cast mining, conversion projects and cross-community projects,
- land use conflicts must be solved through an accommodation of interests, for instance involving development, agriculture, infrastructure or landscape management,
- area-related rights and obligations must be sorted out, for instance if use restrictions, compensation and substitution obligations or reforestation are involved,
- plots must be effectively redesigned as to their location, form, size, service infrastructure and in relation to neighbouring plots,
- the ability to dispose freely of privately owned land must be restored, for instance through reuniting separate ownership of land and buildings,
- the privatisation of formerly state-owned agricultural and forestry property must be supported,
- farmed land must be designed in an effective agri-structural manner in view of the increasing percentage of leased land in agricultural enterprises.

In order to shape the future in rural areas together, administrative action for the application of rural development instruments must be brought up to date according to the following action guidelines:

Preparation is the key to efficient rural development

The condition for good rural development is a thorough preparation of the procedures to be used. For this purpose all stakeholders must gather around a table in order to facilitate discussion on all concerns relevant to the application of the procedure. As there is a strong focus on the goals, even in the preliminary stages, the procedure can be implemented in a clear thematic and timely framework.

Drafting and co-ordinating rural development schemes jointly

Development opportunities for rural areas must be promoted in order to achieve an effective and integrated development scheme. The combined efforts of all relevant stakeholders based on partnership and dialogue are necessary. Financial and human resources should be pooled, in co-ordinating different plans, in launching and taking up initiatives of communities and citizens and in acting rapidly, efficiently and to the benefit of the citizens and rural development in the future

Citizen participation secures acceptance

Pure expert planning is to be replaced by open planning methods which actively involve citizens. The knowledge, experience and ideas of citizens with regard to the development of their immediate home environment must be used. Working groups, village and land workshops and discussions on models for regional and village development are designed to enable citizens to draw up development goals jointly with the planning authorities. Intelligible "bottom-up" decision-making processes lead to a high degree of acceptance and strengthen accountability.

Controlling rural development through moderation

A moderator must be appointed to control the land development process. It is his/her task to moderate the concerns of all stakeholders and to facilitate a planning result, which can achieve consensus, is geared toward implementation and has financial backing. The decision as to who will assume the function of moderator must be taken on the basis of the given conditions.

By mutual agreement, this function can be assumed by politicians, representatives of the Laender, regional or municipal administrations.

16. Summary

One characteristic of water management in Germany is the clear separation between state institutions with global responsibility for the protection and management of water resources on the one hand, and the private or municipal operators carrying out specific functions of relevance to water management on the other hand. The state administration, as a rule, has no direct interest in water use or the use of water

bodies so that in principle conflicts with private interests do not occur. Any significant use of a water body has to be permitted by the competent supervisory authority and no special rights or privileges result from private ownership of water courses which, in any case, exists only for the minor water ones.

The implementation of environmental policy through direct regulation by prescriptions, prohibitions and limit values has, in water resources protection and management, been combined with economic instruments, both for setting incentives and providing revenue. A characteristic of water management, land improvement, water supply and sewerage in Germany is the diversity of small, municipal or regional operating units.

Municipal self-government in cities, towns, municipal associations and rural districts follows political boundaries. Whereas these small-scale units are appropriate for decision-making and operational water distribution and sewerage, larger associations are sometimes needed for water catchment and sewage treatment. The functional self-government in water management associations have proved to be effective for water management functions such as flood control, irrigation and drainage which cannot be achieved within political boundaries, or for functions like long-distance water transfer or the joint operation of (large) sewage treatment plants which require municipal cooperation at a regional level to reach regional objectives. Member's contributions, as well as voting rights, are based on an assessment of respective benefits, leading to equitable shares in making contributions.

At the root of the strength and stability of self-governing units is their financial independence. It follows from cost-recovering water prices and sewerage charges as well as the financing of associations through member's contributions that the associations and municipal operators of water supply and - with some qualifications especially in the new L nder - sewerage do not, in principle, rely on external subsidies.

The concentration of expert knowledge in the technical and scientific associations is also a strength of the institutional system in Germany. Through the voluntary cooperation of experts and institutions, the rules of good practice and the state of the art are developed and are generally made available as rules and standards. The competence of the committee work in these associations is recognised by legislators and implementing authorities in that they refer to the rules and standards of the associations.

The motto for integrated rural development is:

Plan jointly, coordinate your actions, secure a speedy implementation, pool financial resources.

Giving lasting support to the development of municipalities, agriculture, forestry and the natural balance means to actively promote employment for people in rural areas. Agri-structural development planning, land consolidation, special property rules in the new L nder and village renewal provide partnership in land management.

Germany does not suffer from water scarcity, however, water saving measures are taken in all producing sectors. Agriculture, too needs water of good quality for growing crops of good quality and improving productivity. It needs land improvement for this purpose including rural development for other income possibilities.

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