

Country Pasture/Forage Resource Profiles

LATVIA



by
Alexander Adamovich



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1. INTRODUCTION

Latvia is a parliamentary republic, where the President is elected for a period of four years. This system was initially established on 18 November 1918. Both the Declaration of the Renewal of the Independence of the Republic of Latvia dated 4 May 1990 and the 21 August 1991 declaration re-establishing de facto independence proclaimed the authority of the Satversme (Constitution). The highest legislative body in Latvia is the one-chamber Saeima (Parliament), whose 100 deputies are elected for four years in direct, proportionally representative elections by citizens 18 years of age and over. The Head of State is the President of the Republic and he/she is elected by the Parliament. The President appoints the Prime Minister who leads the government (Cabinet of Ministers).

Latvia lies on the eastern coast of the Baltic Sea and between 55° and 58° North and 20° and 28° East; its area 64 589 km² of which 38% is considered agricultural land and 44% forests. Since ancient times, with its coastline exceeding 500 km and easily accessible ports, Latvia has been a significant link between the states surrounding the Baltic Sea and Russia. The Baltic Sea has always been of great importance in its political, economic and cultural life. The overall length of Latvia's boundaries exceeds 1 800 km, 1 350 km of which is land border. Latvia is bounded by Estonia (337 km) on the north, Lithuania (576 km) on the south, Russia (292 km) and Byelorussia (171 km) on the east. The longest straight distance from north to south is 210 km and from east to west 450 km. The length of the Baltic coast line is 495 km.

Among the independent European states only Denmark, Switzerland, the Netherlands, Belgium, Albania and Estonia as well as eight tiny countries are smaller. The total population is 2 319 100 (2004), of which 29.2% is rural (according to World Factbook the July 2006 population estimate was 2 274 735 with a growth rate of -0.67%). The economically active population is 1 400 000. Population density is 36.6 inhabitants/km². The capital of Riga has a population of 806 000 in 2003 which constitutes 34.1% of the total. Administratively, it is divided into 26 districts (496 municipalities) and 26 district towns. District self-government is an administration of a district, which shall, through the mediation of Council (a representation delegated by local (pagast) self-governments) and institutions formed by the Council perform the functions stipulated in the law. The largest cities are: Daugavpils (117 000), Liepaja (96 000), Jelgava (71 000), Jurmala (59 300), Ventspils (50 400), Rezekne (42 900).



Figure 1.1 The Cabinet of Ministers



Figure 1.2 Location of Latvia



Figure 1.3 Territorial subdivision of Latvia into districts

The official state language: Latvian belongs to the Baltic language group of the Indo-European language family. It is one of the two still living Baltic languages, the other one being Lithuanian. Latvian is the native language of about 1 690 000 people in the Republic of Latvia. Additionally, 260 000 in Lithuania, 20 000 in the republics of the former USSR and 95 000 people abroad speak Latvian as a first or second language. The language has developed on the basis of the geographical closeness of its nationalities (Selonians, Semigallians, Couronians, Latgallians). Traditionally three main dialects have been distinguished – the Central dialect (the basis for the literary language), the High (or East) dialect and the dialect of the Livs. The nationalities: custom nationality Latvians – 56.5%; Russians – 30.4%; Byelorussian, Ukrainian, Polish – 9.7%, other nationalities – 3.4%. Religion: Protestants – 29.8%, Roman Catholic – 49.2%, Russian Orthodox – 14.5%, Jews – 3.9%, Anglicans – 1.8%, others – 0.8%.

Though several years have elapsed since the 2000 Population Census was conducted, the all-round and comprehensive information provides the basis for ever new aspects characterizing the population. This time detailed information is provided on the place of birth and nationality of the Latvian population.

Data from the population census show that 1 938 000 or 81.5% of the population were born in Latvia and



Figure 1.4 Apriķi church



Figure 1.5 Aglona basilica

only 435 000 or 18.3% in other countries. For 0.2% of population there is no information on their birthplace according to the census data.

The issue of national adherence is very important in the country. Although the naturalization process goes on, only 1.77 million or 74.5% of the resident population were nationals of the Republic of Latvia; 504 000 or 21.2% were Latvian non-citizens. Only a small part of the Latvia population, i.e. 103 000 people or 4.3%, were nationals of other, mainly European, countries. The number of foreign nationals involves citizens of more than 100 different countries; 73% of all foreign nationals are citizens of the former USSR without any other nationality obtained. Almost 19% of foreign nationals were from the Russian Federation.

Latvia joined the European Union in May 2004. The national currency is the Latvian Lat –LVL (1 lat = 100 Santim = 1.42 EUR).

Latvia has a wide variety of plants and animals: total approved ~27 700 species; animal 18 045 (the greatest part consists of invertebrate, mainly insect), plant 2 434, lichen 492, fungi 4 000, algae (seaweed) 2 680.

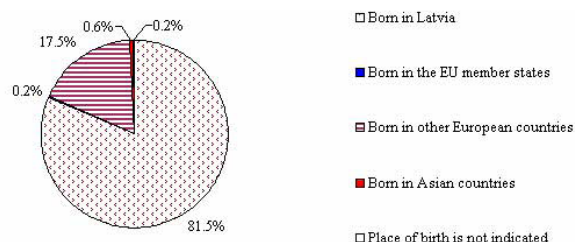


Figure 1.6 Latvian population by birthplace, % of all population

(Prepared by Population Statistics Division)



Figure 1.7 Gauja national park

2. SOILS AND TOPOGRAPHY

Soils

Soils of Latvia compared with other soil regions, provinces and states have a wide range of distinct specific traits. They are mainly determined by parent material, its peculiar mineralogical and chemical composition, and presence of carbonates. Climate, vegetation cover, textural and chemical composition as well as origin of parent material, character of its bedding, bulk density and water-air regime are the factors determining soil genesis.

Latvia is in a humid and moderate climatic region with rainfall exceeding evaporation (soil moisture coefficient > 1) resulting in a percolating moisture regime in the soil. The form of Latvia with its sea coast allows the Atlantic air masses to penetrate the land. Latvia is affected by the warm currents of the Gulf Stream system, and their effect is enhanced by the prevailing westerly winds, carrying the Ocean's moisture and warmth to Latvia. The mean annual temperature is 6.6 °C in Southern Latvia (town Liepaja) and 4.2 °C in Northern Latvia (town Aluksne). The mean annual rainfall ranges from 550 to 600 mm in the lowlands and from 700 to 800 mm in the highlands. The climate of Latvia favours leaching of Automorphic soils, podzol-formation; water accumulation on less permeable soil layers results in soil gleying, bog formation and development of Semihydromorphic and Hydromorphic soils.

The most productive soils of Latvia have been formed on clayey parent materials enriched with carbonates (2–20%), such as moraines, hydrogenic deposits, alluvial and deluvial drifts. Many soils essentially contain no carbonates, being leached out from the upper soil. The soil-forming process has been affected by parent material in two parts; topsoil is usually of coarser textural composition compared with subsoil, which is resistant to water retention resulting in pseudogleying (contact gleying) and bog formation.

Automorphic soils occur on hilly topography and in sites with good groundwater retention; gleysolic, mucky-humus gley soils and bog soils are dominant in areas with low topography and poor water retention; floodlands of river valleys are characteristic of alluvial soils. Recently, 41% of the total land area is under forests. Deciduous trees and grasses are dominant on parent materials higher in carbonates and plant nutrients. Organic material derived mainly from leaves, twigs, and woody material is accumulated on and in the soil; active calcium neutralizes organic acids and retards leaching out of soils and podzol-forming process. Humification, stabilization of humus status in soil and sod-forming result in the most productive soils of Latvia – Sod-calcareous and Brown soils.

Mixed coniferous/deciduous forests are prevalent on non-carbonate parent materials which are lower in plant nutrients and do not contain carbonates. Acid forest litter favours leaching of soils and podzol-formation, resulting in development of Podzolic soils in dry sites and Podzolic-gleyish soils in locations with higher moisture content. Organic matter with low degree of decomposition is accumulated as the result of anaerobic processes in waterlogged areas with prolonged saturation as well as in overgrowing water basins. Available plant nutrients are fixed in little decomposed organic matter, and plants are deficient in mineral nutrients. Due to this, bog vegetation – moss and sphagnum – are dominant resulting in the development of Organic soils.

Major soil improvement methods in Latvia are: drainage and reclamation, liming, build up of humus, fertilizer use, subsoiling, levelling and clearing the fields of boulders, soil erosion control.

According to their hydrothermic properties, Latvian soils are divided into three classes: Automorphic, Semihydromorphic and Hydromorphic. Automorphic soils develop in well drained sites with good water retention, and are usually associated with a deep groundwater table. Due to good decomposition of organic matter under aerobic conditions, these soils are not high in humus.

Development of Automorphic soils is characterized by some peculiarities concerning parent material and processes going on in the soil. Composition of parent material is really diverse: limnoglacial and clay deposits are most widespread in Latvia. Textural peculiarities and processes going on in soils of Latvia are not characteristic to podzol forming processes due to diverse parent material: parent material consists of two parts (the soil strata are composed of two layers) with water impermeable clay layer in lower soil horizons and seasonal upper surface gleying. It is usually determined by geological factors and processes going on in soil, and complex formations of geological factors. Distinct surface gleying of silt loam and clay soils is associated with temporary or prolonged saturation with water in spring and autumn. Most widespread upper surface gleying is the main process going on in soils of Latvia. Percolating water regime is limited to a great extent due to heavy textural composition of soils; it occurs only on sandy parent material. On the whole, processes of soil surface gleying essentially affect genesis of soils promoting or preventing other processes going on in soil. It should be noted that Sod-pseudogley soils with neutral or even alkaline reaction and high in free carbonates in the middle part of a profile were classified as Sodpodzolic contactgleyed soils by a number of researchers from Dokuchaev Institute of Soil Science. Brown soils occur in the southern part of the Zemgale Plain under broadleaf forests and rich grass vegetation. Frequently these soils have developed on limnoglacial and moraine materials. This region is characterized by the lowest mean annual rainfall - 450 to 500 mm and the highest cumulative active temperatures – 2 100 °C to 2 400 °C.

The moderate humid and mild maritime climate of Latvia favours the development of Brown soils in particular areas. Podzol-forming processes do not occur due to intensive biological turnover of nutrients and accumulation of basic cations when carbonates have been leached from the upper soil horizons. A qualitative new process of Brown soil development starts which is characteristic with intensive weathering of parent materials and development of clay *in situ*. Stability of Brown soil development and fertility of these soils are determined by high saturation with calcium and other basic cations. This process is favoured by chemically rich parent material. Brown soils are the most fertile Latvia forest soils with thick humus layers. In the next stages of development Brown soils are moving into Brown lassie soils due to differentiation of the upper soil horizons. Chemical composition of the silt fraction is stable in all horizons of Brown leached soils.

According to the soil classification system the following soils belong to Automorphic soils: Sod-calcareous soils, Brown soils, Podzolic soils, Podzols, Weakly developed soils, Eroded soils, Anthrosols.

Sod-calcareous soils are not widely distributed in Latvia. They mainly occur on flat topography in Zemgale. Most frequently they are found in fields and under forests. Primarily they have developed on parent material containing carbonates as well as on limnoglacial deposits, moraine, gravel, dolomites, limestone etc. The sod-forming process is associated with intensive humus development and accumulation of biogenic (N, P, K, Ca, Mg, S, etc.) elements in the upper soil horizon. Under natural conditions it is typical under grasses and deciduous forest vegetation. Carbonates and basic cations neutralize acids in the soil and prevent leaching and podzol-forming processes. Sod-calcareous soils are slightly leached out, comparatively high in humus content and plant nutrients. These soils have distinct texture. Sod-calcareous soils belong to the most productive soils of Latvia.

Brown soils are not widely distributed in Latvia. They mainly occur on flat topography in the Southern part of Zemgale and under forests in Kurzeme. Brown soils have developed on diverse, chemically rich parent materials, most frequent on limnoglacial and moraine sandy loam which are low in carbonates. Development of Brown soils is characterized by the intensive weathering of primary silica minerals and formation of clayey minerals *in situ*. Due to intensive biological circulation of substances on parent materials which contain carbonates, development of Brown soils is going on resulting in loess soils which develop even into Podzolic soils. Brown soils are among the most fertile soils in Latvia.

Podzolic soils are the most widespread in Latvia – approximately 50% of the total land area including arable land. They occur mostly in fields and under forests in all soil regions of Latvia, even to some extent in Zemgale. Podzolic soils have developed on diverse parent materials, most often on coarse textured parent materials that once were calcareous but now at a depth above 60 cm carbonates have been weathered and leached out. Podzolic soils have developed under the influence of podzol-forming processes. It results in weathering of primary and secondary minerals under the influence of fulvic and other acids (oxalic, formic, citric) as well as under the influence of activities of microorganisms and the leaching out of products of weathering of the upper soil horizons.

Podzols occur mainly under coniferous and mixed forests on coarse textured parent materials. Soils are of low productivity and are devoted to afforestation.

Weakly developed soils and eroded soils. Water erosion is most widespread in Latvia. It occurs on agricultural land with hilly topography. Wind erosion is insignificant in Latvia; it occurs on sandy structureless soils in the coastal regions. Soils are considered eroded if the upper soil horizons are removed and parent material is outcropping in the surface layer of the soil and where soil is under development again.

Anthrosols occur in minor areas where intensive activities by man have left an impact on natural soil-forming processes and soil genetic horizons. Intensive soil cultivation results in very cultivated soils. Recultivated soils, Technogenic soils and Buried soils are distributed among others. Buried soils are not only a result of activities by man; these soils may be developed naturally as, for example, deluvial material of “travelling dunes”.

The development of Semihydromorphic soils is associated either with moderately high groundwater tables or periodic saturation with stagnant water. These soils are approximately one third of the total agricultural land. They occur in all soil regions of Latvia. Properties of these soils have been affected by sod-forming, gleying, podzol-forming and other processes of soil development.

Increased moisture content in Automorphic soils results in the development of Semihydromorphic soils with the process of gleying being dominant. At the initial stages of gleying some gley mottles are distinct; an increase of prominent mottles results in the development of the gleyed horizon and Gleysolic soils. Development of an overall continuous gley horizon results in Gleyish soils. The following types of gleying should be distinguished: bottom or ground gleying; upper (topsoil) gleying; pseudogleying or contactgleying; continuous all profile gleying. The following soil types of Semihydromorphic soils are distinguished: Gleyish soils, Podzolic-gleyish soils, Alluvial soils.

Gleyish soils occur in all soil regions of Latvia; most frequently on parent materials rich in carbonates or where the development of Gleyish soils is affected by mineralised waters containing calcium and magnesium bicarbonates. Sod-forming and gleying processes are dominant. According to the type of gleying (upper, ground, contactgleying) and degree of gleying (gleysolic, gley) as well as depending on soil organic matter content diverse Gleyish soils have been formed. These soils are relatively fertile soils, yet they are in need of drainage.

Podzolic-gleyish soils are widespread throughout the whole territory of Latvia. Most frequently these soils occur on coarse textured parent materials. These soils occur in meadows, grasslands and under forests. Podzolic-gleyish soils have developed as a result of sod-forming, podzol-forming and gleying processes. Commonly these soils have been formed from Podzolic soils under increased saturation with water. Depending on type and degree of gleying, and the organic matter content these soils are subdivided into several subtypes. Podzolic-gleyish soils are comparatively infertile soils with unfavourable agronomic traits; they are in need of overall soil improvement.

Alluvial soils. Distribution of these soils in Latvia is insignificant. These soils occur in former and existing river valleys, the coastal zone of shallow lakes, in areas flooded in spring or having been flooded some period ago. Commonly Alluvial soils occur in natural meadows and grasslands, and are extensive cultivated fields. These soils have derived from muddy silts. Diversity of Alluvial soils has developed depending on flood water streams, textural, humus and chemical composition of the silty alluvia. Deluvial soils also belong to this soil type. Hydromorphic soils have developed under conditions of excessive moisture when the soil surface horizons are waterlogged. All Latvian bog soils belong to Hydromorphic soils. Bog lands are approximately 10% of the total land area. Major areas occur in Piejura Lowland and East Latvia Plain; insignificant areas occur in other Latvia soil regions; minor areas - in Zemgale Plain. Depending on botanical composition and plant nutrition regime we distinguish Low or Grass bogs (Lowland bog soils), Transitional bogs (Transitional bog soils) and Upland or *Sphagnum* bogs (Upland bog soils).

Lowland bog soils are approximately 50% of the total bog area. These soils occur in almost all soil regions of Latvia: in meadows and grasslands, and under swampy forests. Formation of bogs is associated with Lowland bog soils due to nutrient-rich ground waters, waters of underground springs, and rivers. Lowland bog soil peat is usually black in colour, well decomposed, strongly mineralised, mostly loose, and slightly acid to neutral.

Transitional bog soils occur in rather insignificant areas: grasslands, meadows, under forests as well as at the margins of Upland bogs. At depths, nutrient-rich ground waters have a minor effect on plant nutrition; plants with low response to nutrients become widespread. Transitional bog soils are medium between Lowland bog soils and Upland bog soils both by bog vegetation and peat qualities.

Upland bog soils are approximately 42% of the total bog area. These soils occur in Piejura Lowland (Riga-Jelgava-Smarde), North Vidzeme, East Latvia and elsewhere, mainly in lowlands and plains. These soils have derived from plants having low response to mineral substances, primarily from sphagnum which feed on rainfall and air dust. Sphagnum grow rapidly; the cupola-shaped bog surface is slightly elevated in the vicinity. Upland bogs are usually covered with sphagnum, but marsh tea (*Ledum palustre*), heather (*Calluna vulgaris* and *Erica* spp.), blueberries (*Vaccinium myrtillus*), cloudberries (*Rubus chamaemorus*), cranberries (*Vaccinium oxycoccus*) and pines (*Pinus* spp.) may also grow on them. Sphagnum peat is reddish brown and little decomposed. The thickness of peat deposits may even reach up to 10 m. Bog materials are acid or extremely acid; they are relatively low in ash (2–5%), nitrogen (1–2%), CaO (0.2–0.4%) and P₂O₅ (0.05–0.15%). These soils are not recommended for cultivation; they are little used in agriculture.

Source: Karlis Bambergis, Rainis Skujans, Henrihs Mezals, Latvia University of Agriculture

Topography

Latvia is located on the level north-western edge of the East European Plain which has only slight variations in elevation. The average altitude is only about 10–25 m and maximum local relief is about 90 m. The highest point - Gaizinskāns Hill (312 m above sea level) is situated on the Vidzeme Upland in the central part of East Latvia. Most upland is island-shaped, with bedrock cores which rise up to 312 m. Detailed topographic morphological research showed two levels of glacial topography. Uplands and lowlands must be differentiated from relief articulation, i.e. plains, rolling, and hummock relief. They are considered to be large scale relief landforms or macroforms. Flat, rolling, plains and hilly areas are finer taxonomic units or mesoforms, which characterize the brokenness of the surface within each macroform.

The uplands of eastern Latvia (Aluksne, Vidzeme, Latgale and Augszeme) are higher than in the west and north (Northern, Western and Eastern Kursa and Sakala). On the up-glacier side of the insular and marginal uplands of eastern Latvia the boundary of the uplands with the lowlands is marked by the 85–90 m contours, but on the down-glacier (southern) side of highlands 125–135 m contours. The boundary with the radial type of highlands in western and northern Latvia is along the base of the active ice contact slope, and in general corresponds to the 50–60 m contour interval. Towards the south it increases to 80–90 m above sea level. The insular and marginal uplands are characterized by a thick Quaternary cover (more than 40 m, maximum thickness 80–160 m in the central part of the deposits). They consist of primary massifs and areas of plateau-like large hills, morainic and cupola-like hills of medium size and hilly ridges. In the radial type uplands intermediate thickness (20–40 m, maximum up to 80 m) of Quaternary cover predominates. The massifs of morainic and cupola-like hills of medium and small size, as well as, elongated hilly ridges and rolling plains are very common in these areas.

Glaciated lowlands, characterized by rolling or flat relief, are underlain by elongated and broad bedrock or sub-Quaternary depressions. In the territory of lowlands the bedrock surface is covered by a thin, in average up to 10 m, cover of Quaternary deposits. In these areas along river valleys and the seashore, picturesque bluffs of sandstone and less frequently escarpments of dolomite are revealed. Otherwise the lowlands generally are most conducive to intensive agricultural activity.

Three glaciated lowland types are distinguished in Latvia:

- divergent type lowlands with drumlins and genetically related landforms – Northern Vidzeme, Central Latvia lowlands;
- consequent type lowlands with flutings and associated landforms – East-Latvian lowland;
- convergent type lowlands with crumlins (convergent drumlins) and related landforms – Middle Gauja and Mudava (Velikoretskaya) lowlands.

Source: Vitalijs Zelcs, University of Latvia



Figure 2.1 Historical territorial subdivision of Latvia into regions

3. CLIMATE AND AGRO-ECOLOGICAL ZONES

Climate

In spite of Latvia's small area there are important differences in climate between its four climatic zones:

- The coastal (Central) zone, covering 25% of the country, includes the Zemgales plain and the whole coastal region from Lithuania to Estonia. The average annual precipitation is 600 mm. The average temperature varies from -3°C in January to 16.5°C in July. Humidity is low. The growing season, when the average temperature during 24 hours is over 5°C is 185–190 days.
- The Latgales (Southeastern) zone, covering 28%, includes the southeast of the country. The average annual precipitation is 700 mm. The average temperature varies from -7°C in January to 17°C in July. Humidity is high. The growing season is 185–190 days.
- The Vidzeme (Northeastern) zone, covering 30%, includes the north-eastern inland part of the country. The average annual precipitation is 700–850 mm. The average temperature varies from -7°C in January to 16.5°C in July. Humidity is high. The growing season is 175–185 days.
- The Kurzeme (Western) zone, covering 17% of the country, includes the inland part of the Kurzeme peninsula. The average annual precipitation is 700–850 mm. The average temperature varies from -4°C in January to 16.5°C in July. There is medium humidity. The growing season is 190–195 days.

For agriculture, drainage is more important than irrigation. Over 90% of the agricultural land in Latvia can only be intensively cultivated if drained. The current climatic conditions are the continuation of the sub Atlantic climate. The form of Latvia with its long sea coast and surrounding Baltic sea allows oceanic influences to penetrate to the interior of the land. Latvia is characterized by relatively mild winters and cool summers.

For its latitude, Latvia has a peculiar temperature regime since the maritime temperate climate in the western part is transitional to a more continental one in the eastern part. The climate is characterized by moderately cold winters, while summers are moderately hot. The mean January temperature ranges from -3°C to -7°C in coastal regions. The period with the lowest temperatures lasts up to 20–25 February in the western and central regions; in the eastern regions this period lasts till 1–5 March. Springs drag on, and are relatively cool. Latvian summers are cool and rainy. The mean July temperature rises to 16°C – 17°C . Variations in temperature are determined by relief and occurrence of water basins. The westerly winds crossing Latvia determine weather: the temperature of the coolest month drops below 10°C and seldom remains for a prolonged period, while maxima in summer does not exceed 20°C . Mean annual winter temperatures range from $+5^{\circ}\text{C}$ to -5°C in coastal regions; in eastern regions temperatures do not exceed -15°C in winter, and rise to $+30^{\circ}\text{C}$ in summer.

The mean annual rainfall levels of Latvia are rather diverse: 550–600 mm average. Rainfall is generally higher in hilly regions, with slopes facing moist air masses: in the western slopes of Vidzeme

Table 3.1 Average annual precipitation and air temperature

Meteorological station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Precipitation, mm													
Bauska	31	27	28	45	45	61	79	66	64	54	51	43	594
Daugavpils	33	30	32	41	56	73	86	80	62	51	48	39	631
Jelgava	37	32	31	41	50	65	83	73	62	58	53	44	629
Priekuli	31	24	28	41	56	77	96	88	82	68	58	41	690
Riga	33	27	27	42	44	62	85	70	75	61	56	45	627
Ventspils	56	38	38	37	42	46	62	77	77	74	74	66	687
Air temperature, $^{\circ}\text{C}$													
Bauska	-5.5	-5.2	-1.6	5.2	11.6	15.2	17.0	16.2	11.7	6.7	1.6	-2.7	5.9
Daugavpils	-6.4	-6.3	-2.3	5.2	12.0	15.8	17.1	16.0	11.3	6.2	0.9	-3.3	5.5
Jelgava	-4.8	-4.8	-1.2	5.4	11.5	15.4	16.8	16.0	11.7	6.8	1.8	-2.2	6.0
Priekuli	-6.2	-5.9	-2.1	4.4	10.9	14.5	16.7	15.7	11.1	5.6	0.5	-3.5	5.1
Riga	-4.9	-4.6	-1.2	5.1	11.0	15.1	16.9	16.3	12.0	7.0	1.7	-2.0	6.0
Ventspils	-2.8	-3.1	-0.7	4.1	9.1	13.2	16.4	16.1	12.6	7.8	3.1	-0.6	6.3

Source: Karlis Bambergis, Latvia University of Agriculture

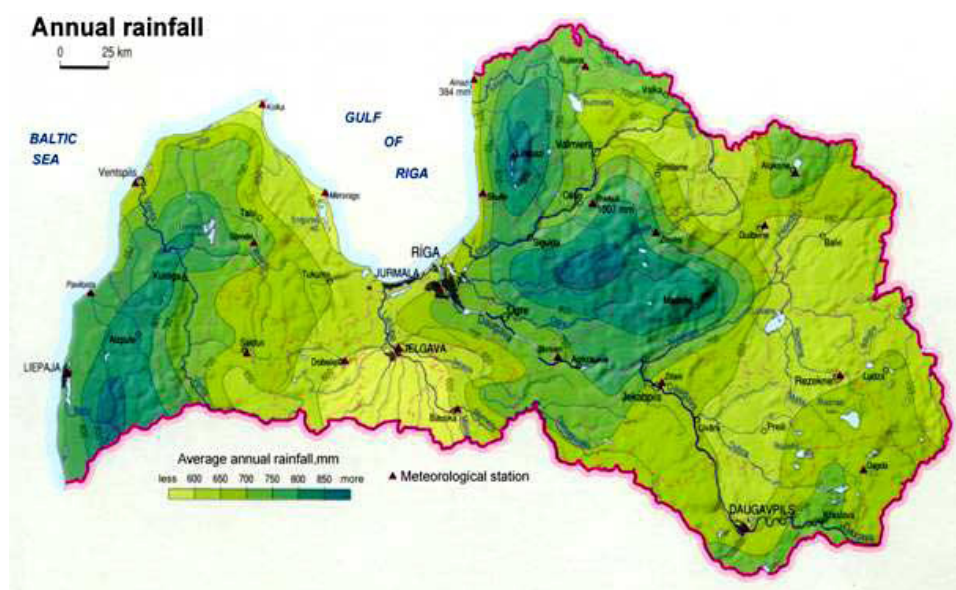


Figure 3.1
Annual rainfall
of Latvia

Upland (700–800 mm), and western slopes of Kurzeme Upland (650–700 mm), while rainfall decreases on eastern slopes.

Much of the rain (70%) falls in April–October. Maximum rainfall (>100 mm) occurs in August. Rainfall is lower in spring.

Precipitation, as constant snow cover, occurs between 30 December and 5 January, but already from December 15 in eastern regions. Early March is the beginning of snow melting in Western Latvia; in the eastern regions it occurs in late March, and in early April in the regions of Vidzeme Central Upland. The thickness of the snow blanket exceeds 30 cm in the most part of the territory of Latvia; in eastern regions with hilly topography the snow cover is 40–50 cm deep.

The soil is frozen 20–30 cm under the snow cover in coastal regions; the depth of frozen soil exceeds 40 cm in central regions, and in eastern regions its depth ranges from 40 to 60 cm. The depth of frozen soil layer may exceed 1 m in extremely severe winters; in eastern regions it is up to 1.20 metres deep.

Westerly and south-westerly winds prevail in Latvia, although other winds may occur between years and seasons as well. The strength of the winds is insignificant: 2–5 m/s., but in autumns may exceed 35 m/s. and 20 m/s. in coastal regions and inland, respectively. The vegetation growth period starts in April, when average daily temperature reaches 5 °C. Intensive crop growing starts with the active vegetation period. This earliest possible date for this period is May 5 and is common for South-East Latvia, and the latest – for Kurzeme coastal line due to the cooling influence of the Baltic Sea.

River basins and surface water resources. Depending on physical and geographical conditions, a large part of the river discharge comes from either snow melt, groundwater or direct surface runoff. About 50–55% of the waters of the Daugava, Venta, Lielupe and Musa rivers is melted snow, while for the Gauja and Amata rivers it is 35–40%. About 10–20% of the flow of some tributaries of the Lielupe (Memele and Svete) and the Aiviekste tributary of the Daugava is fed by groundwater, while for the Daugava and Gauja rivers it is 35–40%. In the Kurzeme peninsula and in the middle uplands, direct surface runoff accounts for 40% of flow of the rivers, while in the Zemgales plain it represents 20–30%.

The Daugava basin has a total area of 87 900 km², of which 28% is located in Latvia. The Daugava River rises in the Russian Federation, flows through Belarus (where it is called the Western Dvina), enters Latvia in the southeast and flows northwest to the Gulf of Riga. Several tributaries enter the Daugava River inside Latvian territory, including four large ones: Ogre, Aiviekste, Dubna and Rezekne.

The Gauja basin has a total area of 8 900 km², of which 88% is in Latvia. The Gauja River rises in the

Table 3.2 Latvia's main rivers

River	Basin area (km ²)		River length (km)	
	In Latvia	Total	In Latvia	Total
Daugava	24 700	87 900	352	1005
Lielupe	8 800	17 600	119	119
Venta	6 600	11 800	178	346
Aiviekste	91 600	9 300	114	114
Gauja	7 920	9 080	452	452

Vidzeme upland and flows east, then turns northwest, becomes the border between Latvia and Estonia for a short distance, and then flows southwest to the Gulf of Riga.

The Salaca basin covers the north of the country, near the border with Estonia. Its total area is 3 600 km², of which 92% is located in Latvia. The Salaca River rises in Lake Burtnieks in the north and flows west to the Gulf of Riga.

The Lielupe basin has a total area of 17 600 km², of which 50% is situated in Latvia. The Lielupe River rises in Lithuania, enters Latvia in the south and flows north to the Gulf of Riga through the most fertile regions of the country. It has many tributaries, the most important being the Memela, Jecava and Svete.

The Venta basin has a total area of 11 800 km², of which 67% is situated in Latvia. The Venta River rises in Lithuania, enters Latvia in the southwest and flows north through the Kurzeme lowland to the Baltic Sea. The Venta has many tributaries, but only one of them, the Abava River, exceeds 100 km in length.

The coastal basins between Lithuania and the Venta have a total area of 5 100 km². This area includes rivers such as the Barta, Durba, Riva and Uzava, which flow to the Baltic Sea.

The basins within the coastal lowland, on the opposite shores of the Gulf of Riga have a combined area of 3 800 km². This area includes rivers such as the Irbe, Stonde, Roja, Svetupe and Vitupe.

The Velika basin consists of a number of smaller rivers flowing into the Velika in the Russian Federation. Its area within Latvia is 3 200 km². The total discharge of the Velika amounts to 4.2 km³/year, of which 16% is generated within Latvia.

Lakes. There are about 2 250 lakes with a total area of about 850 km². About 36% of them are located in the Latgales upland in the southeast of the country.

Table 3.3 Latvia's largest lakes

Lakes	Water surface area (km ²)	Average depth (m)	Maximum depth (m)
Lubanas	80.7	1.6	2.5
Raznas	57.6	7.0	17.0
Engures	40.5	0.4	2.1
Burtnieku	40.1	2.2	3.3
Usmas	37.2	5.4	27.0
Liepajas	37.2	2.0	2.8
Babites	25.6	0.9	1.7

4. RUMINANT LIVESTOCK PRODUCTION SYSTEMS

Cattle numbers and average productivity: historically the dairy sector has always been a priority agricultural sector in Latvia which has favourable conditions from the climatic and soil aspects; compared to other sectors of agriculture dairying had the highest employment indicators.

During the last 10 years during transition to the market economy there was a significant downturn in milk production which affected both the volume of milk production and the structure of dairy farms. In recent years, however, a trend to medium-sized dairy farms with 15–100 cows and modern technology has become quite apparent.

The number of cows (Table 4.1) and the overall milk production level have stabilized in recent years. Thus the average productivity of dairy cows in the reference period (2001–2003) was comparatively stable reaching the level of 4 261 kg/cow in 2003 (Table 4.2).

According to the data of the Latvian State Domestic Animal Pedigree Information Data Processing Centre (SPDPC), until 1 January 2004, there were 389 639 cattle registered in Latvia, of which 218 008 were dairy cows.

The dairy herd is mostly composed of Latvian brown cows – 70% of the recorded cows with average milk-yield of 4 550 kg/cow/year (Table 4.3). The

Table 4.1 Number of cattle (2001–2003, thousand head)

	2001	2002	2003
In all types of farms			
Cattle	384.7	388.1	378.6
of which cows	209.1	204.6	186.3
Including State farms and incorporated companies			
Cattle	50.6	53.8	54.4
of which cows	24.2	24.6	24.4
in residents' farms (farms, household plots and private farms)			
Cattle	334.1	334.3	324.2
of which cows	184.9	180.7	161.9

Source: CSB [Central Statistics Bureau]

Holstein cows constitute 15.6% of the total number of the recorded cows. Analysing the data regarding the results of 2003 by breed cross-section, according to the SPDPC data, in the group of red breed cows the Angler has had the best indices with an average milk-yield of 5 515 kg, content of milk fats 3,23% but this breed constitutes a negligible amount of the total recorded herds.

The introduction of the milk quota system, a fundamental basis for the Common Market Organisation in the dairy sector, is based on the information drawn from the milk producers' register, which will help remodel the milk market of Latvia. The future development of the Latvian dairy sector depends on the introduction and implementation of the elements of the Common Market Organisation.

Beef and veal production

Latvia is well suited to producing beef and veal. The national aim is reaching the self-sufficiency level and quality improvement and the grassland and fodder base is in place. Beef production is mainly a by-product of dairy-farming.

Beef and veal amount to 29.8% of the meat produced. According to the data, the amount of the meat produced and consumed in 2003 has increased. The amount of carcass weight has increased by 1.3 times, but the consumption by 1.1 times.

In relation to pork, the consumption of beef in Latvia is considerably lower. Thus the consumption of beef and meat products (converting to meat) was 27.26 thousand tonnes, correspondingly, the consumption of pork was 66.16 thousand tonnes or by 2.4 times more.

Meat production mainly takes place in farms, household plots and private subsidiary holdings. The structure of beef producing farms is still fragmented, but the number of holdings with more than 500 animals is increasing.

Table 4.2 Quality of herds of cows (2001–2003)

	2001	2002	2003
Number of cows (thousand)	209.1	204.6	186.3
Number of recorded cows (thousand)	74.5	75.8	76.3
Average milk-yield from a cow (kg/year)	4 055	3 958	4 261
Average milk-yield from a recorded cow (kg/year)	4 763	4 833	4 791
Milk fats from recorded cows (%)	4.38	4.37	4.43
Milk Proteins from recorded cows (%)	3.27	3.25	3.24

Source: SPDPC [Latvian State Domestic Animal Pedigree Information Data Processing Centre]

Table 4.3 Productivity of various breeds of recorded cows 2002–2003

Breed of cow	Number of animals		Milk-yield kg/cow/year		Milk proteins %		Milk fats.%	
	2002	2003	2002	2003	2002	2003	2002	2003
Latvian Brown	50 741	68 524	450	4 550	3.31	3.22	4.46	4.45
Angler	380	376	5 242	5 515	3.38	3.23	4.45	4.67
Swedish Red	-	233	-	5 204	-	3.17	-	4.32
Holstein	18 679	29 139	5 220	5 296	3.14	3.09	4.21	4.21
Latvian Blue	61	128	4 671	4 364	3.28	3.19	4.35	4.35

Source: SPDPC

Table 4.4 Balance of beef and veal (2001–2003, '000 tonnes)

	2001	2002	2003
Resources			
Meat, live weight	35.26	29.71	39.20
Meat, carcass weight	19.04	16.04	21.20
Meat import (including the live animals), carcass weight	6.91	7.06	7.44
Imported meat products (converted to meat)	0.02	0.06	0.01
Total resources (converted to meat)	26.27	24.55	29.45
Consumption			
Meat and meat products consumed (converted to meat)	24.50	23.27	27.26
Meat export (including live animals), carcass meat	0.01	0.03	0.02
Export of meat products (converted to meat)	0.37	0.45	0.67
Total meat and meat products consumed (converted to meat)	24.88	23.75	27.95
Stocks at the end of the year	1.39	0.80	1.50

Source: RSS [Rural Support Service of Latvia]

Table 4.5 Beef and veal production by type of farm ('000 tonnes carcass weight)

	2001		2002		2003	
	'000 tonnes	%	'000 tonnes	%	'000 tonnes	%
All types of farms	19.0	100	29.7	100	21.2	100
State farms and incorporated companies	2.4	12.6	4.8	16.2	2.9	13.6
Farms, household plots and private subsidiary holdings	16.6	87.4	24.9	83.8	18.3	86.4

Source: RSS, CSB

Table 4.6 Number of cattle by herd size

Herd size	2001		2002		2003	
	Head	%	Head	%	Head	%
1–5	180 252	43.8	164 278	40.2	144 596	37.1
6–10	61 771	15.0	55 837	13.6	49 015	12.6
11–15	28 491	6.9	25 853	6.3	23 160	6.0
16–20	16 580	4.0	17 524	4.3	16 636	4.2
21–50	36 838	9.0	46 843	11.5	49 496	12.7
51–100	16 158	4.0	22 691	5.5	25 841	6.6
101–500	71 052	17.3	38 371	9.4	41 500	10.7
> 500	-	-	37 666	9.2	39 395	10.1
Total	411 142	100.0	409 063	100.0	389 639	100.0

Source: SPDPC

Sheep and goats

During the last two years the number of sheep has increased gradually and their previous rapid fall in numbers has ceased. The aim in sheep farming is to preserve the genetic diversity, renewal of the herd, development of wool production and increase the trade in meat. Sheep and goats are mainly kept in household plots and private holdings. The average wool clip from a sheep is 3.9 kg.

The production of mutton and goat meat is best suited to small farms. There is a demand for lamb the live weight of which is 35–50 kg.

Goats in Latvia are raised for milk, and cull animals are used for meat. According to the Central Statistics Bureau, in 2003, there was 214 tonnes of milk produced from 5 823 goats in homesteads, milking 432 litres from a goat on average per year.

Horses

Horse rearing in Latvia is performed in accordance with the aims specified in a breeding programme based on the acquisition of high-value animals, the preservation and improvement of the genetic type, by using selected breeding material and by enhancing the horse recording.

It must be noted that the quality of the horses improves due to State aid, herd selection and the implementation of qualitative

breeding and advanced technologies in artificial insemination. In order to maintain and develop further this sector, subsidies to the amount of 134 000 LVL were disbursed to develop breeding activities by using high-value breeding animals and by preserving and improving the existing genetic type.

The implementation of the breeding programme of the Latvian horse breed must be continued, adjusting in circumstances where required the aims of the programme in accordance with changes in the market structure. The basic breed in the selection of which the Latvian horse keepers are engaged is the Latvian horse breed. At the moment, according to the SPDPC data, there are 229 herds with 4 924 horses recorded. This number includes 1 570 mares, 266 stallions, 3 088 juvenile horses, 109 certified stallions, 374 obtained foals; working capacity examinations of 378 juvenile horses have been performed.

Pig production

The aim of the pork sector is to satisfy the needs of the internal market for quality pork and to produce competitive products. It is necessary to increase pork production to saturate the domestic

Table 4.7 Number of sheep by farm types (2001–2003, '000 head)

Farm types	2001		2002		2003	
	'000	%	'000	%	'000	%
All types of farms	29.0	100	31.5	100	39.2	100
State farms and incorporated companies	0.0	0	0.2	0.6	0.2	0.5
On farms, household plots and private holdings	29.0	100	31.3	99.4	39.0	99.5
of which in agricultural holdings	11.2	38.6	12.6	40.3	16.9	43.3

Source: CSB

Table 4.8 Production of sheep and goat meat (2001–2003, tonnes)

	2001	2002	2003
Meat (live weight)	720	703	762
In farms, household plots and private holdings	720	698	758
of which in agricultural holdings	225	264	323
Meat (carcass weight)	361	350	381
In farms, household plots and private holdings	361	348	379
of which in agricultural holdings	113	132	162

Source: CSB

Table 4.9 Total number of horses on all types of farms (2002–2003, '000)

	2002	2003
Total number of horses in all types of farms	18.5	15.4
including in State farms and incorporated companies	1.0	1.1
in residents' farms	17.5	14.3
of which : in agricultural holdings	-	4.8
in household plots and private holdings	-	9.5
Juvenile horses under 3 years of age from the total number of horses in all types of farms	1.9	2.1
including in State farms and incorporated companies	0.4	0.5
in residents' farms	1.5	1.6
of which : in agricultural holdings	-	1.2
in household plots and private holdings	-	0.4
Mares 3 years and upwards from the total number of horses in all types of farms	6.7	4.5
including in State farms and incorporated companies	0.4	0.4
in residents' farms	6.3	4.1
of which : in agricultural holdings	-	1.2
in household plots and private holdings	-	2.9
Stallions 3 years and upwards from the total number of horses in all types of farms	2.5	1.5
int. al. in State farms and incorporated companies	0.1	0.1
in residents' farms	2.4	1.4
of which: in agricultural holdings	-	0.4
in household plots and private holdings	-	1.0

Source: CSB

market to ensure self-sufficiency, as well as to create conditions for the export of pork products by building and modernising slaughterhouses to conform to the EU requirements. In 2003, the total amount of meat produced in Latvia was 71 080 tonnes, pork was 36 910 tonnes which is 51.9% of the total.

Recording pig performance is performed by breeders' associations in accordance with the approved breeding programme for pig farming. The programme provides for the preservation of the Latvian White breed as a gene pool for future. By preserving part of the Latvian White breed without crossing the diversity of pig breeds increases for following

generations. To continue development of the pig-farming sector, subsidies were provided for the implementation of the breeding programme by utilising high value breeding stock. This facilitates formation of competitive pork production herds and increases production efficiency, as well as preserving the gene pool of pig population. In 2003, 1.1 million LVL were disbursed for such purposes.

At January 2004, there were 2 115 pig herds with 312 054 pigs registered on the SPDPC register, an increase of 5.5%, compared with 2002. The largest proportion is in herds with more than 1 000 animals (66.3%).

Table 4.10 Pork production by farm types (2001–2003, slaughter weight)

	2001		2002		2003	
	'000 tonnes	%	'000 tonnes	%	'000 tonnes	%
All types of farms	31.6	100	35.9	100	36.9	100
In State farms and incorporated companies	11.8	37.3	17.5	48.7	18.9	51.2
In farms, household plots and private subsidiary holdings	19.8	62.7	18.4	51.3	18.0	48.8

Source: CSB

Table 4.11 Number of pigs by herd size

Herd size	2001		2002		2003	
	number	%	number	%	number	%
1–50	18 759	10.5	23 213	7.8	24 055	7.7
51–100	8 242	4.6	16 148	5.5	17 203	5.5
101–500	19 514	10.9	47 323	16.0	44 776	14.4
501–1 000	11 224	6.3	16 287	5.5	18 934	6.1
1001–5 000	44 577	25.0	51 517	17.4	58 338	18.7
5001–10 000	51 226	28.7	56 197	19.0	58 099	18.6
>10 000	24 754	14.0	85 042	28.8	90 649	29.0
Total:	178 296	100.0	295 727	100.0	312 054	100.0

Source: SPDPC

5. THE PASTURE RESOURCE

Rural development 38.3% or 2 474 000 ha of the total area of Latvia is occupied by agricultural land of which arable land constitutes 1 832 000 ha. The rest is orchards (29 100 ha), meadows (231 100 ha) and pastures (382 000 ha). According to the State Land Service, 503 100 ha or 21.2% of the agricultural land in 2002 was abandoned agricultural land; of this area 245 500 ha or 48.8% was improved land. From 1998 till 2002, the amount of non-used agricultural lands has increased on average 2% per year. Abandonment of agricultural land is caused by changes in agricultural structure, less investment in rural areas and some land owners live in cities or abroad.

The whole agricultural sector was affected by the transition process. The value of agricultural production fell over 1991–1999 by about 57.2% (1999 relative to the 1989–91 average (Directorate General for Agriculture, 2002). In the pre-transition years the main function of the arable sector was to supply livestock with feed; fodder crop area declined sharply in the transition period. In 1997 fodder

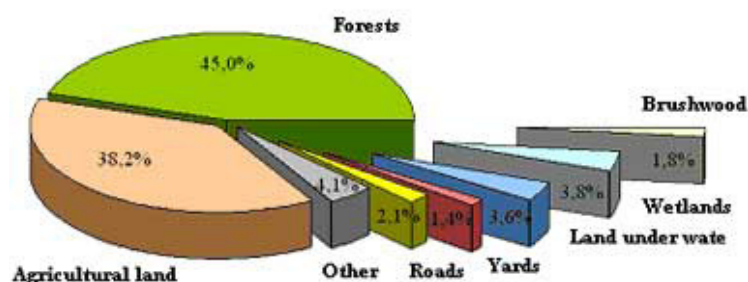


Figure 5.1 Distribution of land considering kinds of land use (2005, % total area of Latvia)

Source: State Land Service, 2005

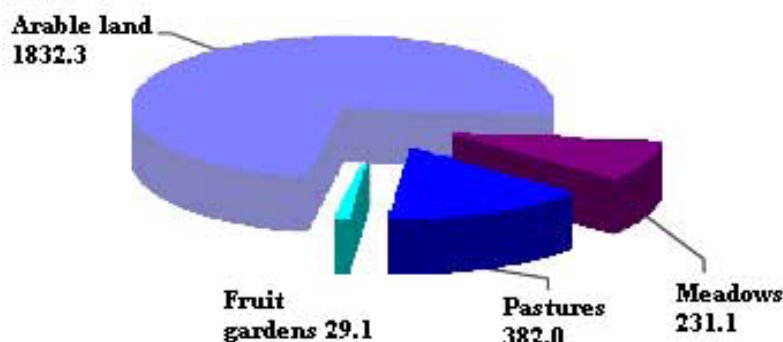


Figure 5.2 Agricultural land by use (thousand ha)

Source: State Land Service, 2005

crops accounted only for half of their area in 1990 (Directorate General for Agriculture, 1998). From 1992–2000 fodder area decreased by nearly 43%, from 718 000 ha to 412 000 ha.

Perennial green fodder in 2002 covered 347 600 ha. Since 1991 perennial green fodder area started declining. Production steadily declined up to 1997, then increased again in 1998 and finally dropped to reach a minimum in year 2001. Yield trends followed a comparable pattern and like other crops were greatly affected by the extremely low use of fertilizers which occurred in the nineteen-nineties; although the use of inputs recovered slightly in 1997, it is still low compared to pre-transition years.

Since the 1930s, the area of forest has increased constantly while the area of agricultural land has decreased. The most remarkable decrease has been in grasslands. Among the reasons are abandonment of land, abandoning traditional management practices such as grazing and mowing, and ploughing of the best areas.

Agriculture started to develop in the Neolithic era in Latvia and the area covered by grasslands and pastures gradually increased reaching a maximum at the beginning of the twentieth century (30% of the total area of Latvia). At this time wet meadows and pastures dominated and covered two-thirds of the total grassland and pasture area. Starting in the twentieth century, due to drainage, plant communities changed and the total area of grasslands and pastures fell rapidly (Latvian Environment Agency, 2001). In 1935 meadows and pastures covered 25.2% of the country (Central Statistical Bureau of Latvia, 2002). In 1999 the share was only 8.1%.

Meadows and pastures include semi-natural formations, sown and cultivated grasslands. Semi-natural grasslands occupy less than 1% of the total territory and can be found mainly in river valleys and in several areas along the seacoast. According to the Latvian Habitat Classification (Latvian Environment Agency, 2001), grasslands are divided into:

Dry grasslands. Dune and sandy grasslands with *Carex arenaria*, *Festuca ovina*, *Lerchenfeldia flexuosa*, *Corynephorus canescens*, *Koeleria glauca*, *Poa angustifolia*, *Phleum phleoides*, *Dianthus deltoides*-*America vulgaris*, *Festuca trachyphilla*; grasslands on rocks with *Poa compressa*-*Saxifraga tridactylites*, *Jovibarba sobolifera*; steppe grasslands with *Helictotrichon pratense*-*Filipendula vulgaris*, *Medicago falcata*-*Helictotrichon pubescens*, *Brachypodium pinnatum*; and grasslands of forest edges with *Geranium sanguineum*, *Trifolium medium*.

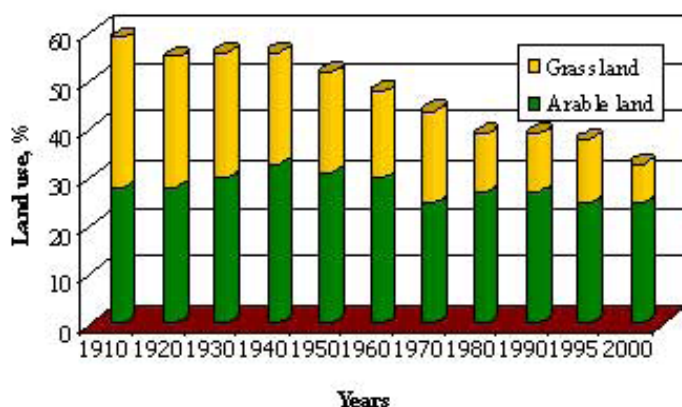


Figure 5.3 Area dynamics of arable land and grassland in Latvia

Source: Central Statistical Bureau of Latvia, 2002

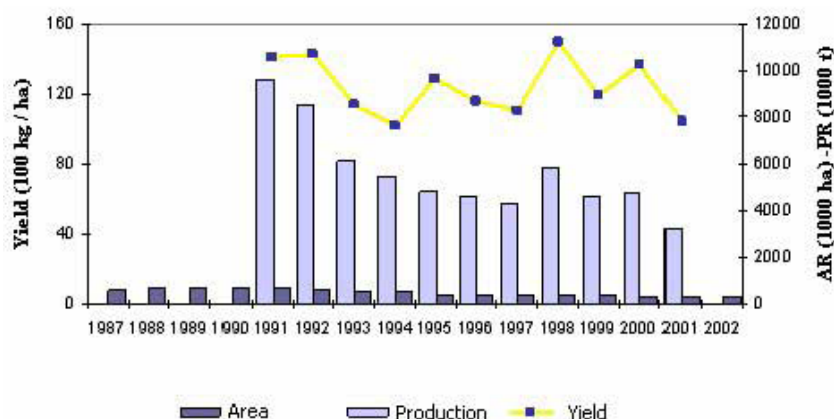


Figure 5.4 Area, production and yield of perennial green fodder

Source: Eurostat

Medium moist grasslands. Grasslands characterized by the genus *Nardus*; fallow land grasslands with *Anthoxanthum odoratum-Agrostis tenuis*, *Anthoxanthum odoratum-Briza media*; true grasslands characterised by *Festuca pratensis*, *Helictotrichon pubescens*, *Arrhenatherum elatius* or *Bromopsis inermis*.

Moist grasslands. Very rich flooded meadows with *Alopecurus pratensis*; grasslands and pastures on rich and medium rich soil with *Geranium palustre*, *Juncus effusus*, *Carex caespitosa*, *Scirpus sylvaticus*, *Geum rivale*, *Filipendula ulmaria*, *Calamagrostis epigeios*; medium rich grasslands with *Molinia caerulea*, *Sesleria caerulea*, *Carex flacca* or *Scorzonera humilis*; coastal meadows with *Agrostis stolonifera*, *Juncus gerardii* or *Alopecurus arundinaceus*.

Wet grasslands. Acid and calcareous small-sedge grasslands and tall-sedge grasslands mainly characterized by *Carex* spp.

Ruderal grasslands. Nitrophile tall-grass communities with *Chaerophyllum aromaticum*, *Aegopodium podagraria*, *Anthriscus sylvestris*, *Epilobium hirsutum* or *Epilobium parviflorum*.

Some very important habitats for maintenance of biodiversity are the semi-natural grasslands, which developed during a long period of human influence. In most of these grasslands, chemical fertilizers have never been applied; thus they are important biotopes for a number of threatened plants. Approximately 40% of protected plant species are found in the grasslands; mainly in river valleys and in several areas along

Table 5.1 Meadows of particular importance in Latvia

Districts	Area, ha	Objects
Aizkraukle	38	Daugava Valley
Balvi	1 481	Meadows of Lubana Lake and Aiviekste Flood-lands
Daugavpils	988	Dviete
Gulbene	638	Pededze Flood-lands
Jekabpils	363	Daugava Valley
Jelgava	1 013	Kalnciems Meadows and Odini Fields, Meadows of Lielupe Flood-lands
Kuldiga	1 763	Abava Valley, Dviete, Kamburi Meadows
Liepaja	425	Floodlands of Liepaja Lake, Flood-lands of Tosmare Lake
Limbazi	119	Randi Meadows
Madona	3 219	Meadows of Lubana Lake and Aiviekste Flood-lands, Meadows of Aiviekstes Floodlands near to Laudona, Crane feeding sites
Rezekne	113	Meadows of Lubana Lake and Aiviekste Flood-lands
Talsi	281	Abava Valley
Tukums	363	Abava Valley
Valka	969	North Gauja Floodlands
Valmiera	588	Flood-lands of Burtnieks Lake
Ventspils	525	Meadows of Uzava Flood-lands, Irbe Valley
Total area	12 881	

(Kabucis et al., 2003)

Table 5.2 Features of natural and cultivated grasslands

	Natural grassland	Cultivated grassland
Plant number in 10 m ²	40–50 plant species and more; high species diversity	1–20 (30) plant species, species diversity low
Plant cover structure	Plant cover includes several strata (3–4), also a moss layer; commonly there are no clearly dominating species. Well-developed sod that is formed by grasses species dense root system	Plant cover structure is simple with 1–2 strata, clearly dominate 1–3 species (sown grasses), sod is not closed.
Management	Traditional management. Fertilized rarely and mainly with manure, plant cover does not regenerate regularly	Intensive management. Regular fertilization mainly with chemical fertilizers, sowing of grasses or renewal by ploughing
Age	Used as a meadow or pasture (regular grazing and/or hay cutting, not ploughed) (10) 15–20 and more years	Grassland age is less than 10 years.

the coast. The most important grassland complexes are those around the Lakes Pape and Liepaja, at Kalnciems, Daugavgriva, in the Lubana lowlands, in Daugava, Venta and other river valleys and in the Randu salt marshes in Vidzeme coastland.

The potential of natural pastures is about 0.7–2 tonnes of dry mass. After fundamental improvement of these types of pastures their productivity increases in 2.5–4.0 times.

Sown pasture in the Latvia is usually multi-species seed mixtures (containing 4 - 6 components) comprising *Trifolium pratensis*, *T. repens*, *Phleum pratense*, *Festuca pratensis*, *Dactylis glomerata*, *Lolium perenne*, *Poa pratensis* with the seeding rate 25–30 kg/ha. Use of legumes in mixtures allows us to obtain high yield over several years without application of nitrogen fertilisers. *Dactylis glomerata* regrows 10–15 days earlier compared with *Festuca pratensis* and 25–35 days earlier if compared with *Phleum pratense*. Fodder galega (*Galega orientalis* Lam.) is a well-known legume for Latvian farmers; it is an early maturing perennial, persists for long periods, and has a high productivity and capacity to fix atmospheric nitrogen (Adamovich, 2001; Raig *et al.*, 2001). Pure fodder galega stands, compared to other legumes, do not thin out over the years so provide stable yields of green feed and seeds. Fodder galega is an alternative forage to cover digestible protein deficit in feed rations and increase the protein content of home - produced forage. The symbiotic potential of fodder galega grown in mixtures with grasses contributes to the production of ecologically safe forage and animal products (Figure 5.1).

Two-species mixtures of *Trifolium pratensis* and *Phleum pratense* are the most popular for the seeding leys, which are two–three-year swards for silage and hay. In recent years imported Danish (DLF Trifolium) seed mixtures and cultivars have succeeded in Latvia given proper management and on suitable soils.

Seed production. The former organized seed-production system collapsed after disintegration of the Soviet Union. In recent years the situation has improved due to imports, mainly from Denmark, Germany, the Netherlands and the USA. The local institution for forage breeding is the Latvian Research Institute of Agriculture. The following grass and legume forage cultivars have been bred in Latvia:

- *Phleum pratense* L.: cv. **Atis** bred by the Latvian Research Institute of Agriculture; cv. **Priekulu 2** bred in the Research Plant Breeding Station in Priekuli;
- *Festuca rubra* L.: cv. **Priekulu 45** bred by the Research Plant Breeding Station in Priekuli;
- *Festuca pratensis* Hud.: cv. **Arita**, cv. **Patra** and cv. **Silva** bred by the Latvian Research Institute of Agriculture;
- *Dactylis glomerata* L.: cv. **Priekulu 30**, bred by Research Plant Breeding Station in Priekuli;
- *Lolium perenne* L.: cv. **Spidola**, bred by the Latvian Research Institute of Agriculture, cv. **Priekulu 59**, bred in the Research Plant Breeding Station in Priekuli;
- *Lolium multiflorum* Lam. cv. **Uva** and cv. **Livabred** by the Latvian Research Institute of Agriculture;
- *Lolium x boucheanum* Kanth. cv. **Saikava** bred by the Latvian Research Institute of Agriculture;
- *Poa pratensis* L.: cv. **Gatve** bred by the Latvian Research Institute of Agriculture; cv. **Urga** bred in the Research Plant Breeding Station in Priekuli;
- *Medicago sativa* L. cv. **Skriveru**, bred by the Latvian Research Institute of Agriculture;
- *Trifolium pratense* L. cv. **Skriveru agrais**, cv. **Skriveru tetra**, cv. **Divaja** bred by the Latvian Research Institute of Agriculture, cv. **Dizstende**



Figure 5.5 Two–three-year-old swards of forage galega

bred by the Research Plant Breeding Station in Stende, cv. **Priekulu 66** bred in the Research Plant Breeding Station in Priekuli;

- *Trifolium repens* L. cv. **Priekulu 61** bred by the Research Plant Breeding Station in Priekuli;
- *Trifolium hybridum* L. cv. **Menta**, cv. **Fricis**, bred by the Latvian Research Institute of Agriculture, cv. **Priekulu tetra** bred in the Research Plant Breeding Station in Priekuli.

Production of fodder grass and legumes seed in the agro-climatic conditions of Latvia is not always economically efficient. According to Latvian legislation only seeds produced in certified fields can be sold. This is the reason for the small areas for seed production in Latvia (see Table 5.3). Production of grass seeds is more stable than that of legumes as it is not so dependant on weather.

Among the above forages, seed production of *Phleum pratense*, *Festuca pratensis*, *Dactylis glomerata*, *Trifolium pratense* is in a good state compared to the others; they are basic species. *Phleum pratense*, *Dactylis glomerata* and *Festuca pratensis* produce 150–600 kg/ha, *Trifolium pratense*, *Trifolium repens* and *Trifolium hybridum* produce 50–150 kg/ha (the seed yield of *Galega orientalis* is 250–600 kg/ha, *Lolium multiflorum* and *Lolium perenne* up to 700–1 200 kg/ha). These grasses are the most suitable for sowing in meadows and pastures mixed with other perennials and in fertile soils in fodder crop rotations with short (2–3 years) swards.

Table 5.3 Seed production (ha, certified)

Forage	2001	2002	2003	2004
Legumes				
<i>Trifolium pratense</i>	1 040	664	640	445
<i>Trifolium repens</i>	19	20	6	7
<i>Trifolium hybridum</i>	14	7	16	15
<i>Medicago sativa</i>	9	8	5	10
Total legumes	1 082	699	667	477
Grasses				
<i>Dactylis glomerata</i>	45	48	55	55
<i>Phleum pratense</i>	696	618	445	319
<i>Festuca pratensis</i>	207	154	144	146
<i>Poa pratensis</i>	1	2	6	8
<i>Lolium perenne</i>	95	133	73	90
<i>Lolium x boucheanum</i>	3	4	25	51
<i>Lolium multiflorum</i>	92	114	247	95
<i>Festuca rubra</i>	75	61	51	56
Total grasses	1 214	1 134	1 046	820

Source: Latvian gazette for plant varieties, 2004, 2005

6. OPPORTUNITIES FOR IMPROVEMENT OF FODDER RESOURCES

The Rural Development Programme for Latvia 2004–2006 includes several measures for management of areas of high nature value under threat. There is an agri-environmental measure “Management of biologically valuable meadows” for the period 2004–2006, under which the total affected territory covers 20 000 ha of biologically valuable grasslands where farmers are compensated for environmentally friendly management of meadows. Similarly the measure “Less favoured areas and areas with environmental restrictions” compensates farmers for agricultural operations in 2000 nature sites. This measure is planned to start from 2005. Implementation of these conceptual models require further amplification and solution of some scientific and practical themes, which in their generalized form are as follows:

- maximal use of the genetic potentialities of pasture legumes in ley management as a prospective direction towards intensified pasture utilization;
- setting up of an efficient system for seed production of perennials under new economic conditions;
- development of modern technologies for direct reseeding of valuable grasses into natural and old-sown plant formations to improve their structure by species and productivity without re-sowing them;
- wide encouragement of rotational grazing to provide uninterrupted feeding of cattle on high-quality pastures during 140–160 days (from April to October);
- improvement of technologies for preparation and storage of winter fodder and forage (silage, and hay) suitable for small private farms and farming enterprises.

The more progressive farmers now recognize the advantages of *Galega orientalis* and *Lolium perenne* for producing high quality hay and silage. The superior value of *Lolium* spp. and *Festulolium* for grazing, and their management is less well known. Research is needed to see if different management practices, together with the use of more recent winter-hardy varieties, can alleviate this problem.

7. RESEARCH AND DEVELOPMENT ORGANIZATIONS AND PERSONNEL

Education and science in the agricultural sector

Vocational Education. The Ministry of Agriculture has three higher educational establishments – the Latvia University of Agriculture, Jekabpils Agrobusiness College and Malnava College; also thirty-one vocational education and training institutions, as well as contractual relations with the non-profit-making body “Rujienas arodgimnazija” Ltd [Rujiena Trade Gymnasium] and two municipal vocational education and training institutions. Priekuli State Technical School of Agriculture, Smiltene Technical School and the non-profit-making body State limited liability company “Bulduru darzkopibas vidusskola” [Bulduri Horticulture Secondary School] have submitted documents to the Ministry of Education and Science regarding starting activities with the status of a college. Adult and teaching methodological work is undertaken by the non-profit-making body “Latvijas Lauksaimniecibas konsultaciju un izglitiba atbalsta centrs” Ltd [Latvian Agricultural Advisory and Training Centre].

Higher Education. The Latvia University of Agriculture (hereinafter – LLU) provides higher academic and vocational education in agriculture, forestry science, veterinary medicine, food science, rural socio-economic development, engineering sciences, information technology and environmental management.

The academic staff of the University is represented by 118 Doctors of Sciences and 22 Doctors Habilitus. The age structure of the academic personnel of the LLU demonstrates that the University should pay even more attention to the renewal of the composition of the professorship.

Institutes and academic institutions carrying out studies on meadow and pasture management and in animal production are shown below in tabular form.

Organization and contact details	Some key personnel	Research topic/responsibilities
<p>Latvia University of Agriculture 2 Liela Street, Jelgava, Latvia, LV - 3001. e-mail: www.llu.lv</p> <p>Faculty of Agriculture Phone: +371 3005679 e-mail: lfaugk@llu.lv</p> <ul style="list-style-type: none"> • Department of Plant Production e-mail: lfaugk@llu.lv Phone/fax: +371 3005629 	<p>Juris Skujans, prof. Phone: +371 30 22584 Fax: +371 30 27238 E-mail: rektors@llu.lv</p>	<p>Rector</p>
<ul style="list-style-type: none"> • Department of Plant Biology and Protection e-mail: lfauk@llu.lv • Department of Soil Management e-mail: lfaak@llu.lv • Department of Animal Science e-mail: lfdzivn@llu.lv 	<p>Aleksandrs Adamovics, prof., Dr. agr. Aleksandrs.Adamovics@llu.lv</p> <p>Valdis Auzins, Dr. agr. Valdis.Auzins@llu.lv</p> <p>Zinta Gaile, assoc. prof., Dr. agr. zinta@apollo.lv</p> <p>Dzidra Krešmane, assoc. prof., Dr. agr., Dzidra.Krešmane@llu.lv</p> <p>Inara Turka, prof., Dr. hab. agr. Inara.Turka@llu.lv</p> <p>Dainis Lapins, prof., Dr. agr. Dainis.Lapins@llu.lv Phone: +371 3005632</p> <p>Uldis Osis, assoc. prof., Dr. agr. Uldis.Osis@llu.lv</p>	<p>Head of department, Grassland research Coordinator in Latvia.</p> <p>Grassland researcher, silage production and use.</p> <p>Grassland researcher, legume and grass forage production in field.</p> <p>Grassland researcher, organic farming.</p> <p>Head of department, waterborne diseases and vermin of plant</p> <p>Head of department, weed control of grassland</p> <p>Animal feeding. Silage production and use.</p>
<p>Institutes of Latvia University of Agriculture</p> <ul style="list-style-type: none"> • Institute of Biotechnology and Veterinary Medicine 1 Instituta Street, Sigulda, Latvia, LV - 2150. Phone: +371 7976654, fax: +371 7976655 e-mail: sigra@lis.lv 	<p>Dace Kravele, Dr. agr. Janis Miculis, assoc. prof., Dr. agr. Baiba Osmane, Dr. agr.</p>	<p>Forage production and use Forage production and use Forage production and use</p>

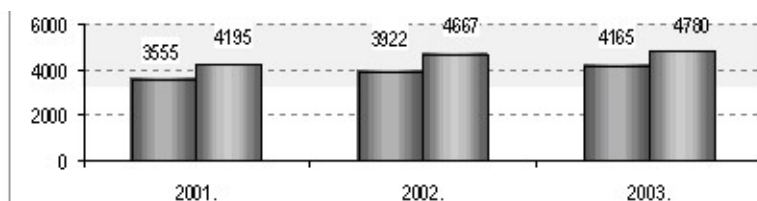


Figure 7.1 The number of LLU students engaged in full-time and half-time basic academic studies 2001–2003

Source: LLU



Figure 7.2. Latvia University of Agriculture

• Institute of Agriculture
“SKRIVERI - 1”, Aizkraukle’s district,
LV - 5126.
Phone: +371 5197266 e-mail: szc@inbox.lv

Aldis Jansons, Dr. agr,
Biruta Jansone, Dr. agr,
Edvins Damberg, Dr. agr.
Maruta Sparnina, Mag. agr.
Peteris Berzins, Dr. agr.
Skaidrite Bumane, Mag. agr.
Iveta Gutmane, Mag. agr.

Director
Breeding of legumes.
Breeding of legumes.
Breeding of grasses.
Breeding of grasses.
Breeding of grasses.
Breeding of grasses.
Grass and legumes seed production.

• Institute of Agriculture Technology
Instituta Street, “ULBROKA”,
Riga’s district, LV - 2130.
e-mail; uzc@delfi.lv

Dainis Viesturs
Phone: +371 7910879, +371 9455258
Fax: +371 7910873

Director

Latvian Academy of Sciences

• Latvian State Institute of Agrarian
Economics
14 Struktoru Street, Riga,
LV - 1039.
Phone: +371 7552786
e-mail: sudat@lvaei.lv

Andris Miglavs, Dr. oec.
andris@lvaei.lv

Director

University of Latvia

19 Raina Blvd., Room 134, Riga
LV 1586, Latvia. www.lu.lv
Phone: +371 7034334
Fax: +371 7243091
E-mail: ad@lu.lv

Ivars Lacis, prof.
Ivars.Lacis@lu.lv

Rector

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9. CONTACTS

This profile was written in 2005 by :
 Professor in Plant Production Alexander Adamovich. Latvia University
 of Agriculture,
 2 Liela street,
 Jelgava, LV - 3001,
 Phone./Fax :+371 3005629
 E-mail: Aleksandrs.Adamovics@llu.lv



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