REG KLAM

Regional Climate Change Adaptation Programme Dresden Region

Managing risks, seizing opportunities

The Dresden region faces up to climate change

ABRIDGED VERSION

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Strategy Concept

of the

Regional Climate Change Adaptation Programme
for the Dresden Region

ABRIDGED VERSION

Contents

The Regional Climate Change Adaptation Programme for the Dresden Region

This broshure is an abridged version of the Strategy Concept which is part of the Regional Climate Change Adaptation Programme for the Dresden Region. This programme comes under the framework of the model project REGKLAM (Development and Testing of an Integrated Regional Climate Change Adaptation Programme for the Dresden Region) funded by the Federal Ministry of Education and Research (BMBF).

REGKLAM brings together regional actors from the fields of politics, administration, business and science. Other regions should also profit from the programme, which can be adapted to specific situations.

Further details under **www.regklam.de** **(only partially in English language)**

The fact sheets for adaptation measures in trade and industry are available in English.
See: http://www.regklam.de/publikationen/regklam-faktenblaetter

I. Action instead of waiting: Strategies for climate change – from the region, for the region

The climate is changing – and even faster than scientists have previously suspected. This means that today we must meet the challenges of climate change at all levels of society. However, we do not yet know how seriously the repercussions will affect various areas of work and life.

Will climate change bring economic opportunities for Dresden and its surroundings? What are the likely risks? Against a backdrop of climate change, how can we protect the inherent assets of the Dresden Region, specifically the high quality of life, the thriving business environment, the landscape and ecosystems?

The Regional Climate Change Adaptation Programme for the Dresden Region can provide some answers to these questions. Created by regional actors from the fields of science, public administration and business, the aim is to prevent climate change from negatively impacting Dresden and surroundings as well as identifying the potentials offered by climate change. The programme is intended to be a role model for other regions in Germany.

The Regional Climate Change Adaptation Pro-gramme for the Dresden Region draws on the work of the German Adaptation Strategy (DAS) and the Adaptation Action Plan (APA) of the Federal government's Adaptation Strategy to Climate Change. It also incorporates useful concepts and measures developed by the Free State of Saxony to deal with climate change and adaptation.

The Regional Climate Change Adaptation Programme was designed around the model region Dresden.

The Climate Adaptation Programme describes the current and expected repercussions of climate change in the region. Furthermore, it specifies a total of 160 adaptive measures in the following areas:

- urban structures, green and open spaces as well as buildings,
- water conservation and management,
- agriculture and forestry,
- trade and industry,
- nature protection.

The programme highlights specific technical and planning measures offering significant adaptive potential yet which may require considerable investments. At the same time numerous alternative approaches are suggested whereby climate adaptation is achieved as a "side effect" of measures that are not expressly dedicated to this purpose. In these cases special planning or investments in climate adaptation are not always required. Rather synergistic potentials can be exploited, e.g. as offered by processes and investments that are pending or occur regularly.

II. The climate is changing: Climate change in the Dresden region

The changing climate is perceptible – even in our region

Global climate change is already having a real impact in the Dresden region. Today we can point to shifts in average temperatures, rainfall and the frequency of extreme weather events.

The Elbe valley and adjacent areas are the most strongly affected by climate change. Rising spring and summer temperatures could become a particular problem in the densely built-up districts of Dresden. However, in the upper regions of the Erzgebirge mountain range the warmer seasons will remain tolerable.

It is highly likely that winters will become increasingly wet, a result of increased rainfall rather than snowfall. In summer we will experience longer dry spells, interrupted by rare yet (locally) severe cloudbursts. And increased water evaporation in the hotter summer period will lead to a drop in natural water levels.

Rising temperatures in the Dresden region

Climate parameters	1961-1990 (observed mean value)	2021-2050 (change compared to mean value)	2071-2100 (change compared to mean value)
Temp: summer half-year (in degrees Celsius)	13.9	+0.5 to +1.3	+1.1 to +3.2
No. of warm summer days (max. temperature ≥ 25 °C)	31.4	+6.3 to +20.0	+13.1 to +48.7
No. of hot days (max. temperature ≥ 30 °C)	5.4	+1.8 to +9.1	+3.5 to +24.6
No. of tropical nights (min. temperature ≥ 20 °C)	0.7	+0.2 to +2.0	+0.5 to +9.0

The climate parameters are based on a mean year of each designated time period in the Dresden region. The predicted values have been derived from various models and future scenarios.

Climate change has repercussions

Climate change can present risks as well as opportunities depending on the specific location and perspective. But one thing is clear: the region can only exploit these potentials and avoid dangers if it quickly adapts to climate change. A recent study by the Federal Environmental Agency has confirmed that the economic, social and ecological benefits will greatly exceed the costs if sensible adaptation measures are implemented.

We must constantly strive to increase our pool of knowledge if we wish to tackle risks appropriately; and thus climate change and adaptation must become topics of study in higher learning and training institutes. Experts and decision-makers must clearly comprehend the changing climate and what the consequences of this will be. It is only with such insight that they can find the right solutions at the right time, and revise their decisions when necessary.

Not only a changing climate

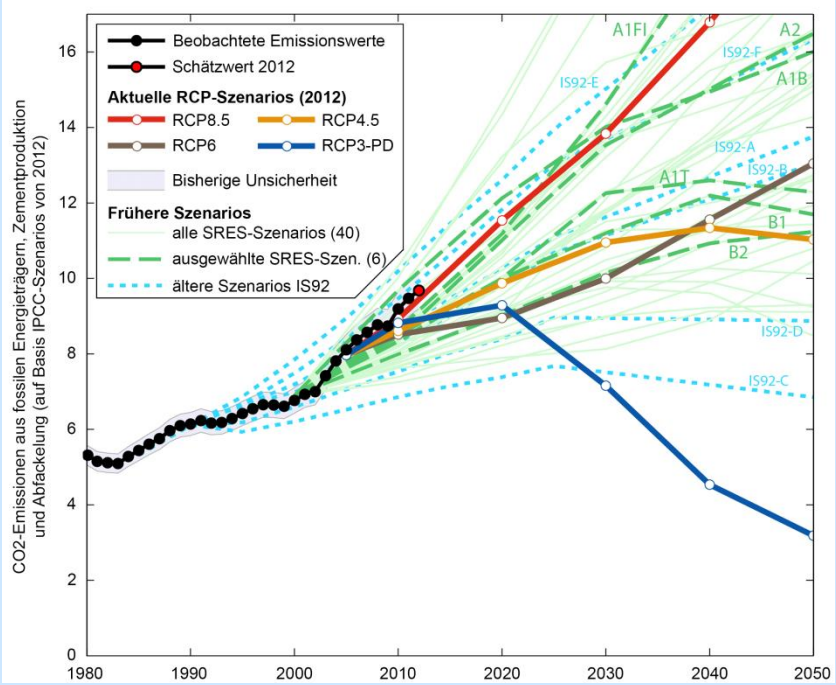
Climate change occurs over a long period of time, during which the social and economic framework conditions are also in flux. Thus it is essential that future scenarios take account of shifting demographic and economic factors as well as predictions on climate change.
Trends can be reliably forecasted by extrapolating from currently available datasets. The resident population of the entire region is expected to shrink by 5.7 percent by the year 2025. One consequence of this will be decreased revenues for the Free State of Saxony and its municipalities: the total revenue for the Saxon government will sink in real terms by approx. 3 billion euros p.a. This highlights the importance of setting priorities for regional climate change adaptation measures and utilizing synergies when addressing implementation.

Climate protection and adaptation: two sides of one coin

Climate protection and adaptation are closely interlinked. Thus adaptive measures must be so designed as to assist in climate protection, or at the very least not undermine this aim. Equally, protective measures must take account of the demands of adaptation. This linking of climate protection and adaptation is not only necessary at the regional level but also at the level of the *Länder*, the national government and indeed the EU.

Incentives must be created to foster climate protection and adaptation. Not just in the form of subsidies provided by the national government or the EU, but also targeted measures to inform and educate. Of course, the national government and the EU need advice on how best to support municipalities in their climate protection and adaptation efforts. At the same time private persons and companies must be better informed about the repercussions of climate change. It is only when individual members of society come to appreciate the importance of climate protection and adaptation, as well as the direct personal advantage to be drawn, that they are willing to change their behaviour and make some real personal investment.

Adaptation to the repercussions of climate change is not an alternative to effective climate protection. If the emission of greenhouse gases is not considerably reduced then we will suffer from even more extreme climate change. The effort to compensate for such change will be huge.



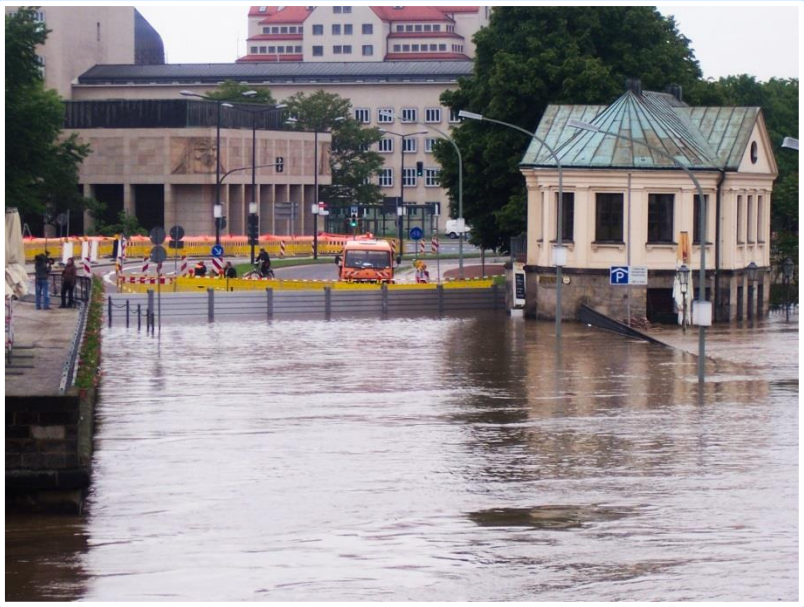
Uncertainties demand flexible adaptation strategies

While some aspects of climate change can already be accurately forecasted by scientists, uncertainties remain due to the many dynamic factors involved. Thus while there is little doubt that temperatures are going to rise, reduced rainfall in summer is viewed as likely but still not certain. Despite a rising tendency towards heat and aridity it is possible that our region will continue to experience damp summers.

Accepting these uncertainties it makes sense to concentrate on adaptation steps which are beneficial today, which will be useful in the near future or at least contain options for adaptation later – regardless of how strong or weak the climatic changes.

We cannot safeguard against all eventualities

In August 2002 Dresden suffered major flooding when the Elbe and a number of its tributaries burst their banks. The city authorities came to realize that modern flood protection requires a review of the entire system of surface and sub-surface waters as well as wastewater infrastructure. Thus the City of Dresden drew up the comprehensive "Flood Protection Plan Dresden", which specified targets and measures to protect all city districts, to be achieved in a step-by-step process.



The city's wide range of flood protection measures has already been successfully tested. The spring flooding of the Elbe in 2006 and, particularly, the major June flood of 2013, underlined the importance of flood protection while at the same time indicating the limits of technical solutions.

Mobile flood protection barrier in Dresden-Altstadt

Monitoring climate change

Our knowledge base of climate change is growing. But will the assumptions we hold today still be true in ten years? What specific repercussions can we expect? Are we planning the correct adaptation strategies, and which of these are to be given priority? How can we keep a lid on the costs of essential adaptation steps? The answers to these questions can only be supplied by a targeted, intelligent and interlinked monitoring system.

We can and must take action

Today we already know a great deal about climate change and its likely repercussions. Thus there is no excuse for inaction. It is vital that climate change be taken into account in long-term investment decisions such as the renewal of urban infrastructure, a company's decision to acquire new manufacturing facilities or the renovation or construction of buildings.

Educate and warn

Politicians, administrators, entrepreneurs and citizens are not passive witnesses to climate change. They are also agents in changing laws, in making investment decisions and in taking personal steps to counter the ever increasing risks. Existing knowledge on climate change must, of course, be made accessible and understandable to these diverse groups of actors. Suitable warning systems can ensure that public health measures and other steps to prevent avoidable damage will function correctly when required.

Skills must be developed to deal with the repercussions of climate change. Scenario-based action plans must be drawn up to defuse risks and cope with emergency situations that are increasingly likely in the wake of climate change, such as periods of extreme heat.

III. Tackling climate change: The Dresden region in action

Goals of climate change adaptation

The local population of the Dresden region should enjoy high living standards in the years to come as well as profiting from a competitive business sector. With this in mind, we can formulate the main requirements of adaptation to climate change as follows:

1. Maintain healthy and attractive conditions for life and work.
2. Seize economic opportunities, minimize risks.
3. Preserve natural resources.

1. Maintain healthy and attractive conditions for life and work

What the future may hold:

Summers are getting warmer. Residents in densely built-up areas are going to suffer increasingly under the intense heat load, impairing their physical performance and in some circumstances even their health. Those with allergies or heart problems, the elderly and children are particularly susceptible to excessive heat, but also those working primarily outdoors. At the same time new demands will be placed on healthcare infrastructures.

But supply problems and rising costs – for example dry spells or severe weather events such as storms or cloudbursts – may also affect other primary infrastructures such as for water supply and removal, energy supply and transportation.

What we can do:

Create green and compact cities

The climate-adapted city is the green city. Municipalities as well as private and public landowners must ensure sufficient provision of green spaces with foliage that offers cooling during hot weather and which can withstand extended periods of heat and drought.

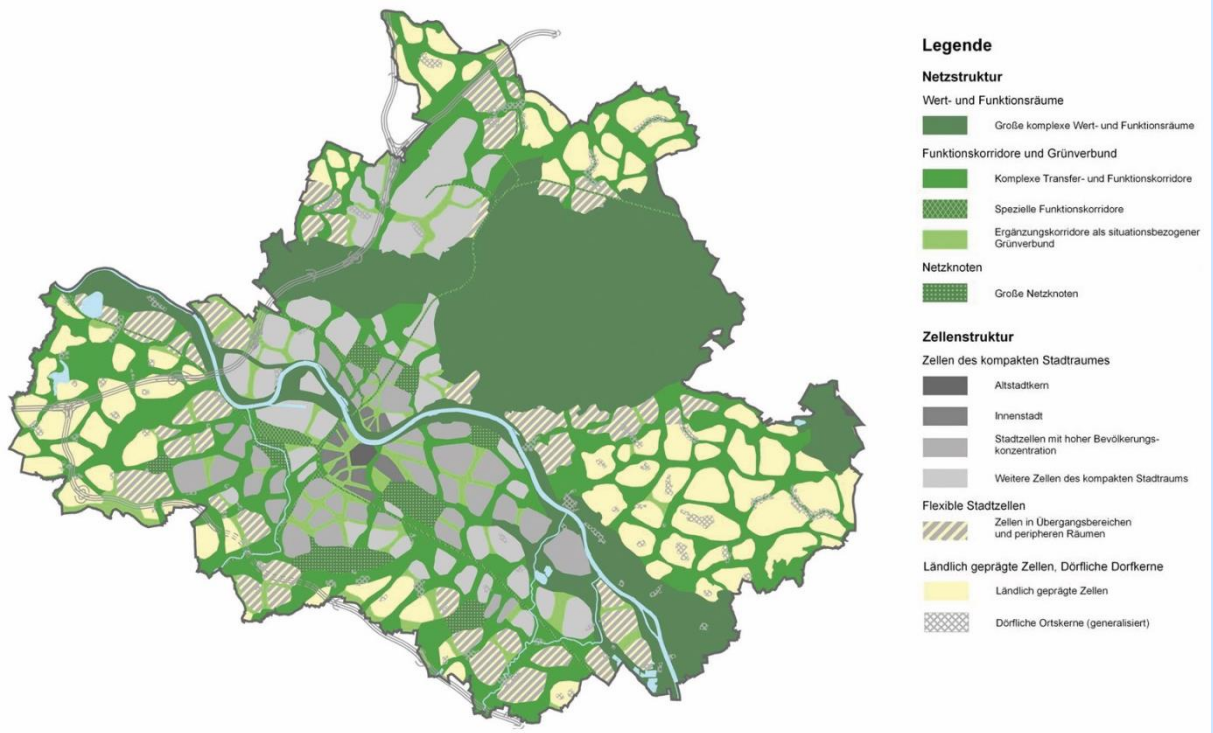
Undeveloped sites should be transformed into green spaces wherever possible. Creativity is required to make our cities and towns greener. For example, companies can turn some of their commercial and industrial land into green spaces, while transport infrastructure, facades and rooftops can be planted with foliage. Municipalities can orient themselves towards the concept of the "compact city within the ecological network", i.e. a city in which the green spaces are connected by corridors, and yet where one still finds compact, densely built-up residential areas.

Those living in such compact towns and cities will profit from shorter commutes to work and for other activities, and thus will more often leave the car at home – an additional boon to environmental and climate protection by reducing CO_2 emissions while also lowering infrastructural costs.

The compact city in the ecological network

Dresden – "the compact city in the ecological network" – is a strategic development model for the Saxon capital. The areas highlighted in green represent diverse green spaces which either already exist between highly developed areas or which are in planning.

In order to implement this plan, it is necessary to transform previously developed sites into new green space. In Dresden this has so far been largely achieved in former military or agricultural sites at the city outskirts. This process of urban greening is much more difficult in the city centre.



Multi-functional usage of urban open spaces

Green- and open spaces have the essential functions of cooling the microclimate and absorbing rainwater. Yet they constitute highly desirable plots for development in already densely populated areas. Multi-functional concepts link the ecological functions of open spaces to a range of additional uses for the local population.

For example, green spaces, which help to regulate the temperature and maintain a good water balance, can also be used for recreation. Such multi-functional usage of green- and open spaces can be more easily implemented when public funding or other forms of finance are available.

A park avoids flood damage and creates recreational space

With the "Windberg Park", the city of Freital has managed to kill several birds with one stone: While meeting the demands of the flood safety concept devised by Saxony's Reservoir Administration (LTV), it has created green space, improved the microclimate and at the same time increased recreational value. The green space concept was jointly developed by the LTV, the district council office (Landratsamt) and the municipalities. The project is co-funded by the Saxon government, the City of Freital and the Federal government through its urban development programme.

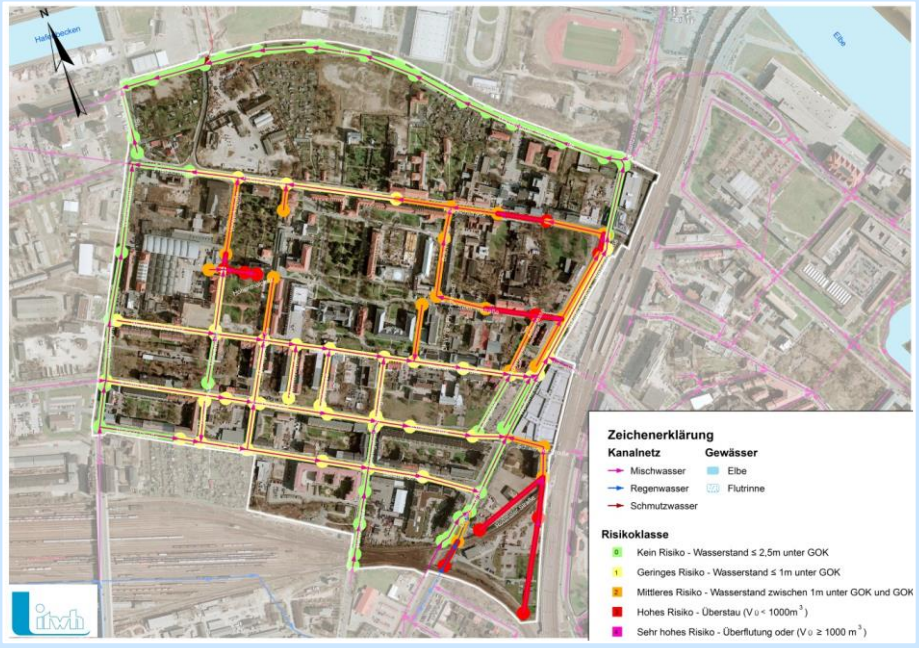
The Windberg-Park in August 2013

Combat sewer flooding

Planning authorities and wastewater companies must take account of the likely rise in the number of violent rainstorms in their water management plans. They must obtain data to indicate which areas of their municipality face the greatest threat of drain flooding during torrential rain. Depending on the local conditions, various practical preventative steps can be taken.

Dealing with hotspots

In the future we can expect climate change to have an impact on public health and hygiene, for example when sewers are damaged or flooded. Some proposals have been made to counter such effects in the area of Dresden-Friedrichstadt, where excess rainwater is diverted over ground to suitable drainage sites, lakes or rivers. An existing pumping station can be adapted to assist in the removal of water from roads after violent rainstorms.



Risk of sewer flooding in Dresden-Friedrichstadt: the red and pink markings indicate areas with a high or very high danger of flooding during heavy rainfall.

Redesigning entire city districts

Cities face a whole spectrum of complex climate adaptation requirements in a relatively small space: Quality of life must be preserved at the same as the microclimate in public spaces is improved by sufficient green- and open spaces. Planning authorities must create ample rainwater retention basins and canals, and determine how floodwater should be removed when the drains and sewers are full. All these demands can be best met when the city district is viewed in its entirety, taking into consideration the interplay of diverse adaptation measures. Complex measures can be realized when the financing of individual projects is bundled.

Adapt buildings

Public agencies and the building sector should work to increase property owners' and tenants' awareness of climate change adaptation, informing them about the various options for adaptation. Those working in the building sector as well as property owners can choose from a wide range of positive steps in climate protection and adaptation, such as the intelligent planning of new buildings and the introduction of adaptation measures when renovating older buildings.

Protect health

Companies can design workplaces to safeguard the health and efficiency of workers even during spells of extreme heat. Child daycare centres and schools should take account of rising temperatures when drawing up their daily timetables. Kindergartens and schools should also play an active role in the education of children – and their parents – about the repercussions of climate change and the impact on their personal behaviour. The action of individual citizens must be reinforced by warning systems, for example during periods of extreme heat, as well as by information campaigns targeted to specific groups and by specific advice.

Climate protection and adaptation go hand in hand

One goal while renovating the offices of the Leibniz Institute of Ecological Urban and Spatial Development (IOER) was to implement effective climate mitigation measures. The result: energy consumption has dropped by 84.5 percent, which translates into 587,000 kWh per year.

By introducing automatic and individually controllable shading systems on all sunny areas of the building and night-time ventilation it was possible to dispense with an expensive and energy inefficient cooling system. In order to further save air conditioning costs, the research institute also relocated its server room.

Special measures required for social welfare and healthcare facilities

Rising temperatures are a particular problem for urban areas as they lead to the increased probability of excessive heat build-up. In terms of danger to health this will prove an acute problem for health care facilities such as retirement homes, medical clinics or kindergartens, as the old, the sick and the very young are especially susceptible to extreme heat. Thus it is necessary to adapt buildings and design public spaces to cope with climate change.

2. Seize economic opportunities, minimize risks

What the future may hold:

Dresden and its surroundings form one of eastern Germany's largest and most dynamic economic regions. Is climate change likely to bring any advantages to companies in the Dresden region? Certain business sectors could enjoy rising demand and a burgeoning marketplace.

Adaptation to climate change can prove a lucrative field for innovative and flexible firms, for example in environmental technologies. However, through its negative impact on production, working and living conditions, climate change can also undermine the regional economy.

Companies must be aware that production conditions can deteriorate through climate change, whether as a result of heat and aridity, dust pollution or extreme weather events.

The risks and opportunities for agriculture and forestry as well as winegrowing are closely interwoven. As temperatures rise, this means a longer growing season and higher yields in previously cooler areas of the region. However, such benefits must be balanced against reduced planning security and possible harvest damage through extreme weather events.

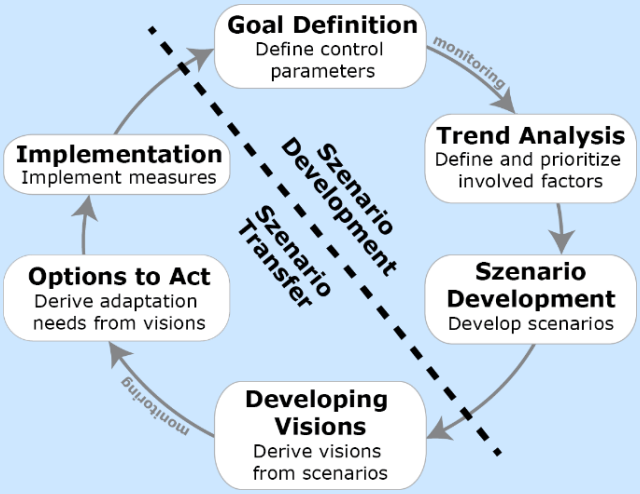
What we can do:

Raise awareness, inform and advise companies

Awareness of the importance of adapting to climate change is particularly lacking in the business sector. Surveys and interviews undertaken by the TU Dresden in several hundred companies have shown that there exist many opportunities for businesses to exploit climate change for their economic benefit. However, it is essential that companies think long-term and learn to take account of climate change when making decisions regarding investment and products. Scientific institutes, chambers of commerce, consultancies and public agencies must develop practical resources such as databanks of measures and guidelines for adaptation. Actors from the worlds of politics and business must work together to expand networks that foster the exchange of know-how and experience on climate protection and adaptation.

The scenario analysis: Is my company ready for climate change?

Companies should make use of scenario analysis if they wish to understand how climate change will affect them. At the heart of this method is the development of various scenarios, from which the companies can derive specific strategies and measures. Expert help is, however, required to evaluate the results.



The steps in scenario analysis

Every company can develop their own individual adaptation strategy. The preferred strategy can be adopted by the entire company, by company sectors or stages in the value creation chain. Some examples:

Strategy "Avoid or safeguard": Damage by extreme weather events can be avoided when suitable adaptation steps are considered during building construction or renovation. Alternatively, the building can be specially insured.

Strategy "Anticipate": Rising temperatures can be considered when planning to renew or replace equipment. This can help to avoid expensive modifications or retrofitting.

Strategy "Stay flexible": Flood damage can be avoided by relocating particularly sensitive parts of the company to higher floors in the building.

Strategy "Substitute": Adapted raw materials can be utilized under changed climatic conditions. For example, seed that is resistant to heat and drought.

Reactivity (capital tie-up, time to maturity, R&D time)	Climate change mean values	Climate change extremes
high (low)	***Substitute*** *e.g. resources such as seeds, concrete; new cultivation areas; development of water reservoirs; water recycling*	***Improve flexibility*** *e.g. conditions of storage, working time (introducing flexitime, flexible break times)*
low (high)	***Anticipate*** *e.g. installation and design of air-conditioning and cooling systems, developing of innovative products such as adapted roofing felt*	***Avoid or insure*** *e.g. climate proof construction, insurance schemes, training, consultancy, emergency plans*

Company strategies to adapt to the repercussions of climate change

Secure production conditions

In order to avoid economic disadvantages it is important to anchor climate change adaptation within business management. Scenario analyses can assist firms in developing adaptation strategies in both the short and long term.
Depending on the business sector and location, some positive measures can be, for example, to improve solar protection as well as rainwater retention, install an emergency energy supply, check the tolerance of essential equipment against dampness, heat and fine dust particles, plan for an enlarged refrigeration capacity or expand storage facilities. But useful measures can also be undertaken which do not require a major upheaval – for example, by relocating servers, production equipment or hazardous materials to areas of the building which are less vulnerable to flooding or overheating.

Foster competitive advantages through innovative adaptation

Companies must show flexibility and innovative strength if they wish to successfully adapt to the repercussions of climate change. Those which prepare for change in good time can enjoy a real competitive advantage, for example through the development of new technologies and services, the refashioning of product portfolios or through lower production costs.

The implementation of adaptation measures requires, however, a systematic investigation of future scenarios as well as the willingness of actors to invest in technologies and to change business processes. Companies, municipalities and citizens have to rely on expert advice, for example from science, trade associations and other professional bodies.

Climate-friendly cooling

The reduced fuel consumption for heating and cooling is the equivalent of 10,000 litres of oil per year. Furthermore, the air-ventilated accumulator is cheaper to buy than a standard air conditioning system.

Before constructing their new production hall, W & S Feinmechanik GmbH installed a pebble-bed accumulator under the floor.

Preserve locational factors for agriculture and forestry

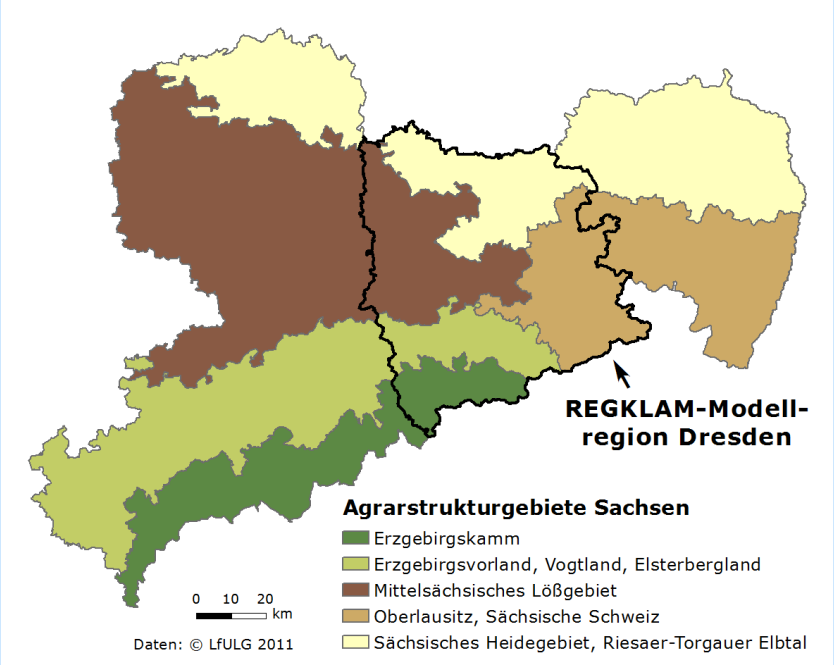
Land parcels well suited to agricultural production and forestry are important competitive factors that also provide vital ecosystem services. Municipalities and regional planning agencies must therefore designate sites particularly suited to agricultural usage in their plans and protect these against development.

One important measure to preserve soil fertility and permanently safeguard agricultural yields is to implement conservational forms of cultivation e.g. such that dispense with ploughing. In this way the farmer can reduce soil erosion while at the same time saving water consumption. Integrated and organic farming methods present opportunities to boost sales and therefore farmers' incomes.

Foresters should increasingly invest in mixed woodland. This can help minimize the impact

when individual tree species are decimated by climate change. Forests near residential areas are particularly deserving of protection as in the future they will ensure a pleasant microclimate and provide valuable recreation space at time of increased summer heat.

How climate change will affect the region's agriculture



Climate change will have diverse impacts on agricultural yields in the regions of Saxony. In the sandy regions of north and east Saxony we can expect smaller harvests in years when little rain falls.

Yet in areas where loam soil predominates, experts predict that climate change will have little effect on agricultural yields. These regional differences highlight the fact that localized solutions are often required when adapting to climate change.

3. Preserve natural resources

What the future may hold:

Climate change will have a direct impact on the water balance, on water bodies, on soils as well as on biological diversity, and thus presents challenges for the preservation of natural resources.

It is clear that competition for these basic resources, which are essential for life, will increase. For example, the economic demand for the continued development of land conflicts with the necessity of expanding open and green spaces to improve the urban climate as well as the preservation of protected biotopes and productive farmland.

Climate changes such as periods of drought and extreme weather conditions present many dangers, not least to the sensitive balance of ecosystems. Habitats that today already have little regenerative capacity will come until even greater pressure.

What we can do:

Ensure sustainable land use and preserve particularly valuable locations

Planning authorities at the regional and state level, as well as municipalities, must create the right framework to help reduce land consumption and better protect land of high climatic, ecological and agricultural value from development. Towns, cities and municipalities must promote the redevelopment of older residential areas rather than allocating new sites for development.

Agriculture and forestry can contribute to soil conservation and thus also to climate protection by ensuring sustainable forms of production. It is also vital to recognize the value of natural areas for relaxation and recreation. An integrated assessment system is required, which takes account of the full range of land usage and its natural features.

Interventions in the natural environment must be adequately compensated

The State of Saxony and the municipalities must take care to avoid unnecessary interventions in the natural environment; and those interventions which are unavoidable – for example if new buildings are needed – must be adequately compensated. At the same time the demands of climate protection and adaptation to climate change must be respected.

Compensatory measures should be so designed as to offer a combination of positive effects. In particular, it is vital that more green space is provided within cities. Furthermore, additional natural areas are required outside of urban centres in order to create a functioning biotope network that can compensate local or temporary habitat losses.

Integrated commitment: More green for Dresden-Gorbitz

In the future, residents can take a stroll on green land where once 300 cars parked: In the district of Gorbitz in Dresden, the Eisenbahner Housing Cooperative (EWG) is unsealing these parking spaces and planting 5,000 trees and shrubs, funded by an intervention compensation scheme of Dresden city council. Green space has the capacity to absorb rainwater and thus reduce the costs of wastewater removal. The sewage system is less frequently flooded, which helps to reduce damage and provides savings for property owners and thus also for tenants.

Restructure land use, improve environmental quality

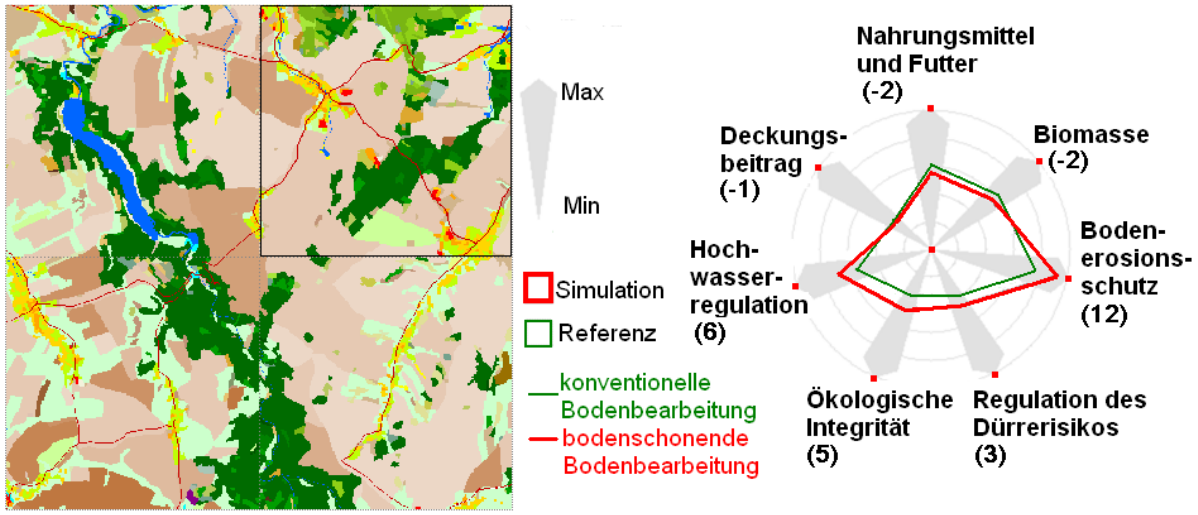
Alongside economic criteria, ecological criteria must in the future be accorded a greater role in decisions regarding land use. Landscapes must be zoned so as to take account of and foster a high diversity of landscape functions. Spatial plans must recognize the importance of preserving space for agricultural and forestry as well as to maintain a healthy balance of ecosystems, thereby exploiting the full potential of sites and minimizing risks. This can only be achieved when the interdependency between agricultural and natural areas is recognized at the regional planning level. One prerequisite for this is to employ spatial analysis and evaluation based on criteria that can illustrate diverse forms of use and function as well as likely effects of land use changes.

Working in tune with nature

At Castle Wackerbarth, where the vineyards extend to around 100 hectares, the cellar master believes that you just have to live with a degree of uncertainty in agriculture. He sees rising temperatures in this northerly, and thus cooler, winegrowing region as an opportunity - if extreme weather events do not become too frequent. The art consists in taking the right action to meet the challenges of diverse meteorological phenomena.

Aids for decision-making to help safeguard and develop landscapes and agricultural yields

In the face of climate change, it is more important than ever to safeguard against land erosion through farming. Yet how effective are such protective measures? And how do they interact with other forms of action? Here tools to support the decision-making process can prove vital in carefully guiding the development of agriculture and in determining the best land management strategies for a location.



Simulations can greatly assist the decision-making process, particularly in regard to multi-sectoral tasks.

Safeguard the water supply

In the future water companies and dam authorities must monitor more closely the reservoir system in order to quickly detect any impact that climate change has on water quality and then develop adaptation measures. Improvements must also be made in the monitoring and protection of groundwater. Municipalities should encourage the formation of groundwater by unsealing surfaces. The onus is also on farmers to reduce land erosion and the seepage of fertilizers and pesticides into rivers and lakes by employing new farming techniques and land use concepts.

Better protection of sensitive ecosystems

The self-regulating capacity of most ecosystems in the model region is already impaired by diverse forms of human activity and intervention. Many ecosystems are not sufficiently robust to withstand the additional pressure climate change imposed on them by climate change. Nature protection agencies must therefore act to reduce existing interventions in order to give sensitive ecosystems the chance to activate their natural adaptation potential. In this regard it is vital to introduce new forms of soil cultivation as well as crop rotation and green buffer zones. Green belts around protected sites must be enlarged or adapted in order to capture eroded topsoil.

Creating a network of animal and plant habitats

Animals and plants can adapt to new climate conditions if they have the opportunity to migrate to more favourable biotopes. This implies that habitats, and in particular protected areas, must be linked to one another to create a biotope network.

Thus landscape permeability must be improved between protected areas. Barriers to migration such as weirs or roads must be removed or should be rendered passable, for example using so-called fish ladders or wildlife passages.

To ensure that the biotope network is accepted by all involved parties, it is advisable to seek a general consensus regarding the multi-functional use of the connecting land strips. Such usage could be, for example, as erosion or wind barriers or simply to increase the stock of woodland.

IV. In the Dresden region and elsewhere: Consolidate, increase and apply knowledge

Generate and provide access to knowledge

Now and in the coming years the Saxon Government will have the task of collecting and evaluating data to ensure the timely forecasting not only of climate change but also social, demographic and economic trends. Universities and research institutes must provide knowledge on climate change, they must develop feasible adaptation strategies and foster innovation. The State's research policy must support these tasks.

Teaching the facts

If we wish to take an active part in preparing for change then we must be as well informed as possible. Schoolchildren should learn how best to safeguard their well-being against the repercussions of climate change and how to preserve our natural resources. A study conducted by the Consumer Protection Agency has shown that such topics have until now scarcely been dealt with in Saxony's schools.

However, it is also vital to provide public agencies, municipalities and companies with training and information on climate change. Only thus can they take sufficient account of these changes in their plans and decisions. Politicians and the municipalities have the responsibility of informing the public about the repercussions of climate change, thereby strengthening their sense of personal responsibility.

Exploit synergies, avoid conflicts

In order to exploit synergies and avoid conflicts it is necessary that climate protection and adaptation be handled together rather than separately. This is particularly true of the building industry. Intelligent insulation systems, for example, offer both heat and cold insulation which allows to save heating and air-conditioning costs as well as to reduce CO_2 emissions. Modern ventilation systems and highly efficient heat recovery technologies are another option to combine climate pro-

tection with climate adaptation in the same investment.

Thus the twin topics of climate protection and adaptation to the new climate regime must be accorded greater importance in the education and training of planners, architects and construction engineers. Many more experts must be trained in climate adaptation in order to provide specialist know-how to property developers. Certificates and seals of approval issued for high quality, environmentally-friendly construction must increasingly recognize the demands not only of climate protection but also climate adaptation.

A change of climate in schools

As part of the seminar series "Saxony in Climate Change", climate experts and other speakers are welcomed into Saxony's schools to talk about climate change. In 2010/2011 this venture was recognized as a UN "Education for Sustainable Development" Decade Project.

Tree planting programmes, such as shown here near Dresden, are also a useful way to teach children about the impact of climate change.

Enlarge and exploit networks

The repercussions of climate change affect many aspects of nature, society and the economy. Therefore, it is vital that adaptation measures make use of available synergies. The development of a regional climate adaptation plan for Dresden and surroundings generated a great deal of expertise on climate change and adaptation, and also led to a number of close collaborations. This is an impulse to continue such cooperative ventures in the future. It is essential that entrepreneurs and scientists, politicians and public administrators as well as members of federations and societies, all become involved in this topic and work towards implementing necessary adaptation measures.

A real boon for environmental and climate protection: "Ökoprofit"

The environmental management project "Ökoprofit" (Ecological Project for Integrated Environmental Technologies) helps small and medium-size companies here in Saxony to reduce their resource and energy consumption as cheaply as possible. The voluntary project is aimed at firms from all sectors of the economy. Participation in the project is a positive first step to realizing a coordinated system of environmental management. Since 2007 companies participating in "Ökoprofit" have made savings of almost 4 million euros by reducing their consumption of energy, raw materials and water. In future "Ökoprofit" consultation will focus more strongly on the topic of adaptation to climate change, specifically those aspects which are already a part of the climate adaptation programme of the Dresden region. Thus "Ökoprofit" will make a direct contribution to the implementation of this programme.

Good examples as role models and stimulus to action

In the REGKLAM project, partners from scientific institutes work together with representatives of public agencies and the business community to develop analyses and concepts to deal with climate change. These techniques have already been introduced in municipal, regional and state development plans. And the topic is firmly secured for the next years with the project "Ökoprofit". Climate protection is also the aim of "Umweltallianz Sachsen", a voluntary agreement between the Saxon state government and businesses to ensure that company growth and development is environmentally friendly.

These are only some of the projects that illustrate the benefits of inter-sectoral collaboration in climate adaptation. It is now time to anchor this topic within the numerous existing initiatives and processes in the region in order to make climate adaptation an integral part of decision making.

V. An action programme for the Dresden region: The main points at a glance

The Climate Change Adaptation Programme for the Dresden region has given the starting shot: now politicians, decision-makers and actors from all areas of society are called upon to actively promote adaptation to climate change.

State and municipal authorities have to set up the necessary framework conditions. Alongside climate protection, adaptation to climate change must be firmly anchored in municipal decision-making.

Regardless of their field of responsibility, everybody is called upon to play their part in dealing with climate change, whether entrepreneur or scientist, conservationist or house owner, from pressure group to individual citizen.

Top priority should be given to adaptation measures that are certain to have a positive effect, regardless of how the climate will actually develop in the coming years. For example, someone who insulates their house against heat and cold saves energy costs today, while also safeguarding against the likely climate changes of tomorrow. Municipalities that work to extend green spaces are improving the quality of life for their citizens now and ensuring a better microclimate at the same time. This will also be a real boon in the face of higher temperatures in the years to come.

Perhaps our greatest challenge is to leave be-hind no ecological and economic burdens for coming generations to deal with and thereby reducing their scope for positive action. Thus adaptation to climate change serves to boost sustainability.

If we are clear-sighted in our actions then we can maintain – and perhaps even strengthen – our region's great locational advantages. In order to be successful we must act now rather than later. The Regional Climate Change Adaptation Programme is one mainstay in this effort.

If we want to maintain healthy and attractive living and working conditions, seize economic opportunities, minimize risks as well as preserve the natural environment and its resources for the years to come, then it is vital that we begin at once to tackle the following tasks:

1. **Monitor climate change and its repercussions; develop flexible adaptation strategies:** One urgent goal is to set up a climate monitoring system in Saxony designed to meet the information needs of regions and municipalities. This will allow adaptation strategies to systematically build on existing expertise. Actors must recognize that knowledge of climate change and its repercussions will become ever more precise in the future. Therefore, priority must be given to measures which are beneficial today and which can be easily adapted to meet the better understanding of tomorrow.
2. **Strengthen climate change adaptation; climate protection and adaptation should be considered together and not in isolation:** Climate protection and adaptation are not mutually exclusive. It is vital that our political leaders and the public at large understand the necessity of tackling these tasks together.
3. **Create compact cities and towns; entire urban districts must be redesigned:** Urban spatial planners must meet the challenge of creating cities that are both compact and green. The "compact city in the ecological network" is a suitable concept for this task. In order to flesh out and implement this concept, it is necessary that all relevant actors work closely together.
4. **Adapt buildings to cope with the impact of climate change:** Investment in building adaptation will only take place when there is a wide-ranging understanding of the impact of climate change. This understanding can be fostered by targeted information campaigns. Dedicated certification can increase the market value of climate-adapted buildings, thereby creating incentives to adapt buildings and steering the process of adaptation. At the same time such certification gives property owners and tenants the assurance that they are doing something useful for the future.

5. **Enhance municipal flood prevention; solve the problem of flooded drains and sewers:** It is vital that we develop new concepts in municipal flood prevention. These must also include targeted solutions for the every more frequent flooding of urban districts and sewers. Cities and municipalities must identify areas at risk, improve natural rainwater absorption and adapt infrastructures, including the road and sewer network, in order to minimize damage.

6. **Information programmes, warning systems and infrastructure in the health sector must be improved and interlinked:** Climate change can endanger our health. Therefore, it is vital to better explain the human impact, especially to groups at high risk. Warning systems must be developed. Social and health agencies must develop networks capable of safeguarding the community's health in the face of increasing challenges.

7. **Educate the business sector; commercial risks and opportunities must be recognized in good time:** The region's companies must be directly informed of the likely impact of climate change on their value added. Regional competitiveness can be strengthened by an exchange of information between companies regarding the advantages and disadvantages of climate change. In particular, today's long-term planning decisions must take account of climate change in order to avoid bad investments and to better grasp windows of opportunity.

8. **Preserve and enhance locational factors for agriculture and forestry; strengthen soil protection:** High-yield sites, also beside expanding cities and municipalities, must be specially protected against development and reserved for the planting of crops and raw materials. Medium- and long-term land use in the region should be determined on the basis of ecological and economic criteria in order to safeguard potentials (yields, habitats) and minimize risks (e.g. erosion). Crop rotation and methods of cultivation must be correspondingly adapted.

9. **Modify woodland stocks to increase resilience:** Foresters must improve the resilience of woodland against harmful influences such as storms and pests. In particular, sensitive spruce and pine stocks must be modified.

10. **Avoid interventions in natural landscapes; protect and interlink sensitive ecosystems:** Human interventions in natural landscapes should be strictly limited in order to protect sensitive species and habitats. Activities that negatively impact, for example, the water balance (through land drainage) or protected areas (the seepage of fertilisers) should be reduced to an absolute minimum. An effective biotope network must be created in order to improve the resilience of ecosystems.

11. **Consolidate and disseminate available knowledge; targeted expansion of networks:** Companies, public officials, citizens and politicians still lack sufficient knowledge of the repercussions of climate change. Therefore, it is necessary to develop closer collaboration over the short- and long-term between representatives of politics, business, civil society, education and science. Also targeted programmes of information dissemination and consultation must be set up.

12. **Act to create exemplary projects and measures that can be easily copied:** The climate change adaptation programme for the Dresden region encompasses a range of exemplary measures to combat climate change. Such good examples must be fostered. They encourage and stimulate individuals, companies and public bodies to action.

Imprint

Managing risks, seizing opportunities
The Dresden region faces up to climate change
Strategy Concept of the Integrated Regional Climate Adaptation Programme for the Dresden Region
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