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# THE ROLE AND IMPORTANCE OF CULTURAL ECOLOGY IN COMBATING CLIMATE CHANGE

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Cevdet Yılmaz<sup>1\*</sup>

## ABSTRACT

In the 21st century, one of the most important problems our world faces is global warming and the resulting climate change. In the solution of the problem; reducing greenhouse gas emissions from fossil fuels and saving energy use are the first suggestions that come to mind. In the process of combating climate change, people's actions and choices should be in harmony with nature, practices that harm nature are expected to be reduced. In this study, it is emphasized that cultural ecology and traditional local knowledge can be a guide for achieving a balance in nature-human relations. In this respect, it is aimed to illustrate the importance of sustainable lifestyles and modes of production in rural Turkey by recognizing the local geography. Rural architecture and the cultural ecology of agriculture in Anatolia were selected as two thematic areas, and the data obtained through field studies and face-to-face interviews were interpreted. As a result, it has been concluded that rural architecture examples are rich in functional solutions designed according to climate and seasonal conditions, which contribute to savings in energy use, annual cooling and heating energy demand can be balanced with the use of natural environment characteristics, and traditional ecological knowledge can guide the solution of today's problems.

**Keywords:** Climate Change, Geography, Cultural Ecology, Energy

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## 1. INTRODUCTION

Until the 19th century, human beings have survived for thousands of years to the extent that they adapted to the natural environment in which they lived, otherwise their lives were endangered. In the last two centuries, humans have gained superiority over their environment and rapidly changed it through industrialization and the technical means it has brought.

In the meantime, they have used fossil fuels in abundance, created many environmental problems, especially human-induced global climate change, and turned the world into a place with pathological disorders. As a result of the overuse of natural resources and ecosystem destruction, societies and countries face various problems. In parallel with population growth and the development of technology, intervention in natural environments has increased, and resource consumption and environmental pollution have reached a level that threatens living health. One of the biggest problems faced on a global scale is climate change. There are countless research and publication activities related to this problem and new ones are being added every day. In these studies, emissions of gases such as carbon dioxide, methane and nitrous oxide are cited as the main causes of the rising global temperature. The last three decades have been the warmest since 1850, and if emissions continue at current trends, the average air temperature in the period 2081-2100 will be 4.8°C higher than in the period 1986-2005 [1].

Vulnerability to climate change can be broadly defined as “the relationship between the degree to which a community or system (physical geography, ecological system or socio-economic sector) is affected by or vulnerable to climate change stress (stress and pressure), the level of meeting or responding to stress (sensitivity) and the level of adaptation to climate change (adaptive capacity)” [2]. Due to changing climatic conditions, energy demand for heating and cooling in residential buildings may increase, albeit differently in cold and hot climates. In a study [3], it is stated that energy consumption will decrease in Northern and Central Europe due to global warming, while in Southern Europe, the increase in cooling demand will be higher than heating demand. Based on three cities (Curitiba, Florianópolis ve Belém) from different locations in Brazil, it is projected that there will be an increase in annual energy demand between 19%-65% between the three cities in 2020; 56%-112% in 2050; and 112%-185% in 2080. In the coldest city, annual heating energy demand will decrease by 94% in 2080 due to an increase in average temperature and global solar radiation. In another example, in a study on the potential impact of climate change on heating and cooling energy consumption in residential and office buildings in Switzerland, four climate scenarios were evaluated for the period 2050-2100, and energy consumption for cooling in Zurich was projected to increase by 223% and 1050% in 2050 and 2100 respectively, while energy demand for heating was projected to decrease by 36% and 58% in 2050 and 2100 respectively [4]. At this point, how to combat human-induced global climate change and how to cope with new changes is of worldwide importance. Although not on the scale of today, human beings have always encountered natural disasters such as drought, floods, frost, extreme cold, most of which are related to climate, and have learned to cope with these problems in order to survive, and have developed numerous skills and adaptations in this direction. However, today, in rural areas where technology has not yet penetrated with all its elements, people adapt to their environment by using many methods without consuming fossil



fuels and polluting the atmosphere, and manage to survive without disturbing the natural balance. At this point, methods that prioritize less energy use, environmental health and ecosystem protection come to the fore. So what is the way to stop the adverse conditions caused by global climate change or to develop strategies to cope with changing climate conditions? The aim of this study is to evaluate the importance of recognizing and taking into account local geographical conditions in the process of adaptation to the effects of climate change, and the unique examples we have identified regarding cultural ecology and traditional ecological knowledge for this process. Architecture, agriculture, food production and related processes, which are among the most concrete human activities, are directly related to climate. Practices based on agricultural knowledge and methods that take into account local geographical conditions such as climate, soil, land structure, do not harm or cause little harm to ecosystems, and where solutions to problems are often found and applied locally can contribute to adaptation to human-induced climate change and reduce the effects of new adverse conditions.

## 2. METHODS

The approach of this study is based on cultural ecology, which explains the processes that may develop in the case of recognizing the geographical environment in which we live, acting in accordance with it or not. This branch of science, which focuses on how humans benefit from their environment without harming it, can bring some solutions to the problems of global climate change, even if only partially. One aspect of cultural ecology, which is a research approach within the human-environment relationship, is cultural adaptation.

Cultural adaptation is a change in the traditional structure of a group of people over a long period of time in order to respond to and adapt to structural changes in the natural environment, new technologies, political system, etc. [5]. In the context of global climate change, it should be recognized that human-environment relations can be shaped by a range of social and cultural practices, and that local, regional or even global political, cultural and economic systems may be behind any change in the natural environment [6]. Cultural ecology offers an interdisciplinary approach to mobilize a cultural shift and radical decisions for the urgent fight against climate change. Traditional ecological knowledge, which best reflects culture and ecology as well as local geographical characteristics, is a cumulative body of knowledge, practices and beliefs about the relationships of living beings, including humans, with each other and with their environment that develops through adaptive processes and is passed down through generations through culture [7]. The study is based on the ways of life and production that reflect the cultural ecological elements that already exist in our country. In terms of the adaptation process to global climate change, evaluations were made under the following 2 themes with various examples from Anatolia based on local geography:

a) Architecture in harmony with the geographical environment, b) Traditional preservation of food and reduced energy use through traditional ecological knowledge in Anatolian agriculture. Rural dwellings and the relationship between food preservation and energy saving were analyzed based on geographical observations between 2018 and 2022. The data obtained are categorized and interpreted under sub-headings.

### 3. FINDINGS

#### 3.1. Architecture Compatible with the Geographical Environment

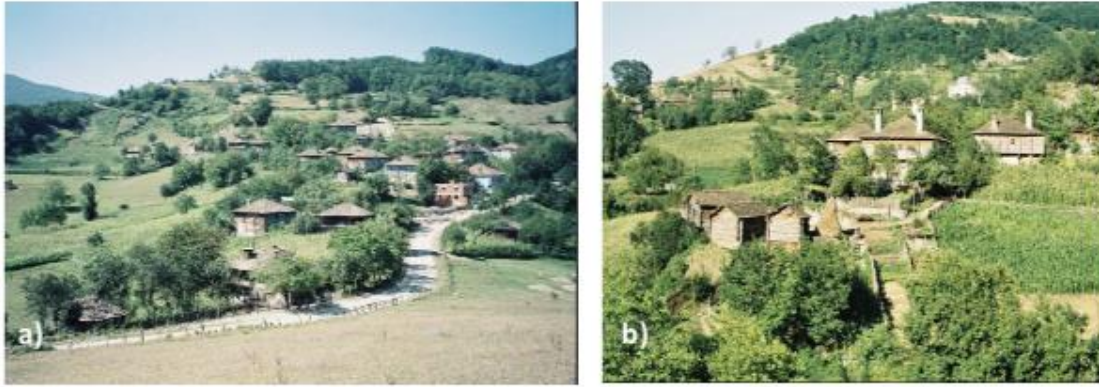
##### *Climate, seasonal conditions, residential architecture and energy conservation*

One of the most important characteristics of rural architecture in Turkey is that it is developed in harmony with the geographical conditions in which it is located. Adaptation to the geographical environment seen in traditional architecture is directly related to climatic elements such as temperature, precipitation, humidity and wind, as well as land structure, lithology and vegetation. For example, the front or one of the facades of the house facing the sun; paying attention to the direction in which the crops and animal feed will be dried; taking into account the resistance to climate and precipitation in the selection of trees for the building; measures to protect the house from wind, humidity and blizzards are some examples of adaptation to the geographical environment. This adaptation increases the lifespan and durability of dwellings, and with its functionality, savings can be achieved in the use of time, space and energy, and new costs can be eliminated. Material selection and planning according to climate and seasonal conditions are always important in architecture for an environment suitable for human life. Considering the effects of climate change, energy demand and need for heating, heating and cooling in homes may change over time. Design and applications that will balance the effects of heat and cold will be required to achieve the desired bioclimatic comfort characteristics in the most suitable climate and weather conditions for human life. Looking at the rich architecture of Anatolia, it is seen that whether in semi-arid areas or in rainy, humid regions, dwellings suitable for the natural environment have been developed. This general view can be explained with an example from the Black Sea Region (Photo 1). In the traditional architecture of the Ayancik region, the use of stone and wood together in the humid environment of the Black Sea to provide a technical solution for the rainy climate, and the fact that the production of stone and wood, the source of which is an edible material, requires relatively little energy shows both the design suitable for the geographical structure and sustainability [8, 9].

##### *Location relative to the sun*

When looking at examples from Anatolia regarding energy saving in rural dwellings, designs to meet various needs such as solarization of houses, thermal insulation, heat preservation and distribution within the house, and outdoor food drying are observable features. The positioning and shape of houses in relation to the sun affects the amount of energy needed and used. In rural areas, the ways in which families heat their homes or retain heat and prevent cold air from entering the house are often related to a) the use of sun-facing facades in summer and winter, b) the interior layout of the house, c) insulation mezzanines, d) siding and shutters, and e) livelihood types-livestock. In houses, the use of sunlit and non-sunlit rooms is changed according to the seasons to save heat and light. In the winter months, the more sunlit rooms on the south and east sides of the houses are generally used, while in the summer, the summer rooms close to the body wall of the house are used because they are cooler.





**Photo 1.** Houses with one side facing the sun;  
a) Sinop, Ayancık, Armutluyazı village, b) Sinop, Türkeli, Satköyü

*Summer room-floor; winter room-floor application*

In today's cities, the amount of energy spent to keep the houses cool in summer and to heat them in winter is quite high. However, with the application of summer and winter floors in traditional Turkish houses, people have lived the most efficient life with the least amount of fuel and have been able to realize a sustainable lifestyle without destroying their environment (Photo 2). In local architecture, simple solutions have been developed to maintain heat balance, provide ventilation and prevent the entry of cold air (Photo 3). For example, in the "Şavşat house" in the Artvin region, the ayvans allow the house to be ventilated naturally. These houses are two-storey wooden structures with the lower floor used as animal shelter and the upper floor as living space. On the living floor, there is a corridor that divides the rooms into two and connects the two opposite sides of the house, and two doors lead to the ayvan. The "ayvan" is a semi-open balcony-like structure that surrounds the house without a partition and is used to pass into the house. In this architectural design, air circulation is possible in the house in all seasons.



**Photo 2.** Bursa, Cumalıkızık village (HTML-1); houses usually have three floors;  
1st floor is entrance, 2nd floor is winter, 3rd floor is summer.



**Photo 3.** Bursa, Cumalikizik; middle floor winter floor; narrow, low, easy to heat.  
Upstairs summer floor; wide, spacious, airy.

Another issue is the function of building windows. Double glazing is used to reduce the effect of outside noise and cold air. Again in rural architecture, houses in cold and high areas have wooden shutters on the windows. By closing the shutters, the effect of the sun or cold air is reduced, depending on the season. Another element is the roof shape and roof covering material of the buildings. Roofs, with their materials and shape, can either reject or retain heat. This can be illustrated by comparing stone and wood roofing with sheet metal roofing in rural dwellings. According to the owners, in the past, when wood (hartama, bedevra) was used for roofing, various foods such as dairy products and dried fruits could be kept in the attic for a certain period of time in hot weather, but this was not possible with the use of sheet metal in the 1980s.

#### *Heat saving with rooms with stove*

In the house interior plan, there is a structure embedded in the wall, called a hearth or open fire, which is always located in a room of the house and provides warmth and heating. The room with the hearth is the space used by the family together, especially in the winter months, and heat distribution is provided through passages to other rooms. Most of the hearths are closed and stoves are placed in front of them and many cooking and drying processes are carried out at the same time (Photo 4).



**Photo 4.** Fireplace and rovine stoves are used to heat homes while cooking and drying at the same time, saving energy.

Another example of doing more than one job at the same time with less energy consumption is to utilize the heat from the stove by opening the living room and kitchen in modern houses. A similar practice has been applied in public institutions to save heat (Photo 5).





**Photo 5.** A stove system in an old school in Giresun, where a single stove heats two adjacent classrooms.

*Utilization of other heat sources; barns, insulation floors*

Depending on animal husbandry, animal shelters were built close to the living areas, both side by side or in the form of lower and upper floors. For example, in the Eastern Black Sea Region, in the high and cold regions, the first floor of traditional houses in the high and cold regions was used as a winter room and the side of the house was used as a barn. In winter, the lower floor was warmer than the upper floor thanks to the heat of the barn and the thick logs. Again, especially in wooden houses, a narrow intermediate floor about 20-30 cm high was left between the barn ceiling and the house floor. This area was filled with materials such as soil and ash (Photo 6). Thus, the barn odor was prevented from passing to the upper floor and the heat of the barn and the house was maintained.



**Photo 6.** The isolation gap between the barn and the living space in two-storey traditional houses.



*Architecture compatible with rainfall conditions, geomorphology and reducing the impact of natural disasters*

With climate change, seasonal anomalies and sudden precipitation will trigger an increase in floods and landslides. In rural architecture, the land structure, lithological characteristics and the risk of flooding and inundation affect the durability of the dwelling. In areas where the ground water level is high and the slope is far away from the slope value where the rainwater will move away quickly, the houses were built by taking some precautions (Photo 7). For example, in the Çarşamba region of Samsun, old houses on the plain were raised on stilts to keep them away from water and moisture (Photo 8). Since these local conditions are the same, the same technique was taken as an example in the concrete houses built later.



**Photo 7.** Flood disaster in the Çarşamba Plain - Yeşilirmak Delta on June 22, 2019 (Source: DHA). Two examples of delta houses built on poles high above the ground, very few of which have survived to the present day in case of similar problems in the past.

### **3.2. Traditional Ecological Knowledge and Food Preservation and Climate Adaptation in Anatolian Agriculture**

#### *Agriculture adapted to local geographical conditions*

Agriculture is one of the most important areas to be affected by changing climate conditions. Local climate and agricultural systems in different parts of the world are facing threats such as drought, rising waters and increased erosion. Considering population growth and the provision of food, which is a basic need, a balance between the protection and utilization of agricultural lands and the most reasonable adaptation strategies to new conditions should be determined. Many engineering solutions designed to mitigate climate-related risks, such as early warning systems and crop monitoring, are being developed. However, local solutions developed thousands of years in the past against

changing natural environment characteristics and the best of which have survived to the present day should also be discovered and adapted to the present day. Indeed, our country has a rich diversity in terms of both geographical conditions and local dynamics of agricultural activities. Anatolian agriculture, which has reached the present day by experiencing various conditions in thousands of years of agricultural history, contains a memory to be used in solving current problems. Uses appropriate to the quality of land are in themselves a natural protection against the effects of climate change and a method of adaptation to new conditions. Growing crops in accordance with the structure of soils and the availability of irrigation water; protecting the soil by terracing sloping lands and creating planted areas are examples of local methods.

#### *Traditional agricultural knowledge and skills*

Traditional ecological knowledge and practices in Anatolian agriculture, which has developed adaptation to its geographical conditions, are of great importance in the process of adaptation to global climate change. These themes can be examined in various ways such as soil recognition, soil protection, soil fertility, planting and planting in accordance with local climate and soil conditions, alternation, multiple planting, seed collection and seed preservation, fallow, natural solutions to plant diseases, traditional preservation methods. With this knowledge and practices, crops can be grown in accordance with climatic elements such as drought, rainfall, humidity or seasonal anomalies. Growing crops in accordance with soil and water availability is important for the sustainable use of soil and water resources. The ability to solve a problem encountered in agricultural production with local possibilities and the use of less energy and chemicals also support adaptation to the natural environment.

#### *Less energy use*

In the past, when household appliances based on electrical energy did not vary, there were many items used for similar functions (Photo 8). For attractive reasons such as saving time, being easier and faster, a transformation has begun in households and kitchens. Electrical appliances are now being used more and more for tasks that can be done and prepared by human hands. Do we have to use electricity and consume energy in all of the items we have started to use in the kitchen, almost all of which are electrical. Can't some of these things be done with physical labor as in the past?



**Photo 8.** Kitchen utensils used in the recent past and recently replaced by electric appliances. The question is, do we do everything with electric tools now, or can we save energy by doing some of it by hand, as in the past?



### *Energy consumed by freezers and traditional preservation of food*

When it comes to using less energy in kitchen appliances, deep freezers undoubtedly attract the most attention (Photo 10). Especially in rural areas, these containers, in which vegetables and fruits are stored as soon as they are available, cause a huge energy consumption, and most of the time, when the value of what is stored in them is compared to the electricity consumed, it is more than a hundred percent. Today, many people store food in electric coolers to extend its shelf life, increasing energy use and incurring heavy bills. However, for thousands of years, our people living in rural Turkey have been able to develop very important methods of preserving and extending the shelf life of their food without utilizing depletable energy resources.

### *Traditional preservation of food; grain and fruit stores built in rocks and tuffs*

Thick layers of tuff formed in volcanic areas and karst caves seen in karst topography have been used for the storage and preservation of various crops since the past. These practices, which constitute one of the best examples of adaptation to the natural environment, are a form of utilizing the physical environment through culture. The most common and well-known of these in our country are the natural warehouses in Nevşehir region. The towns of Kavak and Ortahisar in Nevşehir are an example of food storage by utilizing the natural environment. In the region, naturally cooled underground storages have been widely used since the past. Tuffs on the slopes of river valleys are carved out and used without the use of energy.

Thousands of tons of fresh fruit can be stored in these storages for months without any energy consumption. In these warehouses, ventilation shafts with a diameter of 25-30 cm and a height of 15-17 m are built at 5-6 m intervals. Trucks also enter the warehouses to unload their cargo. For this reason, the height of the warehouses from the ground varies between 4.8-5.5 m and their width varies between 4-6 m. There are more than 500 naturally cooled underground storages in Kavak and Ortahisar towns [10]. Another example of tuff deposits in volcanic areas is the Güzelöz (Kayseri) and Şahinefendi (Nevşehir) tuff deposits in the Middle Kızılırmak Department (Photo 9). Thick layers of tuff were carved out with modern excavators and transformed into warehouses where crops can be stored for 7-8 months. The materials are natural and the structures are artificial, but in terms of storage conditions, the conditions provided by this type of warehouses are close to the room climate in modern cold storages.

The average temperature inside the warehouse in summer and winter is around 5°C, provided that the insulation of the warehouse with the outside is safe [11].



**Photo 9.** Natural storages formed in tuff layers in Nevşehir region.

Rock cracks and karst caves in karst areas are used for food storage, preservation and ripening in Anatolia. One of these caves, the Peynirini Cave within the borders of Mülâyim Neighborhood of Derbent District of Konya Province, has long been used for ripening tulum cheese, as the name suggests (Photo 10). The year-round temperature in this cave is around 6-7°C and the cave air has high humidity saturation (99.6-100%) [12].



**Photo 10.** Konya / Derbent / Mülâyim village / Peynirini Cave (Photo: Ayşe Dağlı)

Cold storages, which are used to protect, store and delay the spoilage of various foods, especially against the heat of summer, are called icebox, “buzhana”, “buzhane”, “daran”, “mahsen” in Anatolia (Photo 11). Although there are refrigerators in homes, some food is placed in ice houses in addition to refrigerators as needed. According to the testimony of those who use the icehouses, they are not worried about power cuts when daily or weekly food is stored there. Therefore, in the event of a power cut, the ice houses are used with peace of mind.



**Photo 11.** “Icehouses” in the natural environment, in karst areas and around the house.



### *Storage by storing in earthen wells*

One of the ways of preserving some vegetables and fruits in the natural environment is through earth wells (Photo 12). This type of well aims to keep vegetables and fruits fresh throughout the winter. Wells dug in the soil and by human hands are also shaped according to the type of crop.



**Photo 12.** Different shapes of earthen wells used to keep certain vegetables and fruits fresh; 1. Cylindrical vertical wells, 2. Deep and wide surface wells, 3. Deep and rectangular wells.

### *Dry storage in warehouses and “serender”s*

Warehouses and serenders, which are extensions of the house, are used for drying and storing products such as corn and hazelnuts, as well as some vegetables (Photo 13). Since at least one year’s worth of food was to be preserved, the inside of these structures should be away from moisture. For this reason, they were built without windows. Similar to warehouses, there are also vineyard warehouses with two floors, the upper floor of which is used only for grape storage and which, like warehouses, are windowless [13].



**Photo 13.** Serender and granaries are notable for their versatile functionality by drying or storing food in a dry environment.

### *Boiling and nature-dried storage.*

Increasing the duration of use by transforming the fruit is done by boiling and drying the fruit in the sun or by making “pestil” and “köme”. Sun exposure time is important for proper drying of foods based on manual labor and traditional methods. Drying and preserving in nature is usually done in summer and fall. Similarly, another method is to first dry local cheeses and then soak them in water and shred them to make them edible. What is distinctive in this example observed in the Artvin region is that the drying

of cheese is done even in January in settlements in the valleys. For this process, cheese drying cabinets were built as a small addition to the open space in the front facades of traditional dwellings called gazebos (Photo 14). The fact that the low-lying settlements in the valley are relatively warm and the valley breezes may have played a role in the development of this method.



**Photo 14.** Boiling in cauldrons (Sinop), rotatable food drying greenhouse in the gazebo of houses (Artvin), hanging (Artvin) and drying fruits and vegetables (Şanlıurfa) (HTML-2).

#### *Cool storage in cellars of houses*

In the periods when electrical energy was not used, small additional structures were built in or near the house or the ground floors of the houses were used to keep various food products cool and stored for a certain period of time. Thus, various food storage areas, which cannot be considered independent from the house and have an important place in daily life, were created (Photo 15).



**Photo 15.** The cellars close to the houses and agricultural fields were the storage units for vegetables, fruits and liquor.

## 4. CONCLUSION AND RECOMMENDATIONS

In this study, examples from the cultural ecology of Anatolia are given to the search for solutions to the causes and effects of global climate change. Especially through the themes of architecture and agriculture, it is conveyed that a life and production style in harmony with nature also saves energy, creates less waste, and that a sustainable life already exists. Traditional knowledge and methods can also be utilized in solving the global problems we face today. The appropriate solutions found by taking lessons from the problems that human beings have experienced and encountered can be adapted to the current processes. While scientists are looking for solutions to the effects of climate change on a global scale, the people who are experiencing these problems themselves, such as those facing the threat of rising sea levels, can be monitored to see what kind of solutions they come up with to survive in their current environment. For all these, the human-nature relationship should be looked at more closely, and solutions identified in the context of cultural ecology should be generalized and developed as suggestions for solving global



problems. For example, tuff warehouses, structures called ice houses, and earthen wells can be used as alternatives to modern cold storages and coolers used in homes, which consume a lot of electrical energy. With its 10,000 years of settlement history, Anatolia has countless examples in this regard.

Although this study briefly focuses on agriculture and rural architecture, many areas are waiting to be examined. Our task is to collect this information before the last representatives of Anatolia's ancient culture who live in the rapidly emptying countryside - with internal migration and urbanization - disappear, and to make use of them for the solution of our future problems, including today. Local governments should take the lead, scientists and geographers should explain the characteristics of the place, appropriate house plans should be made, examples should be taken in Anatolia. Climatic changes have a direct impact on traditional agriculture, the types of crops grown, production, the productivity of meadows, the working hours of farmers. Local geographical knowledge is therefore the best guide to understand the current situation. In the face of climatic changes, many local solutions for the construction of new houses, the temperature of the home environment in hot and cold weather in rural dwellings, its suitability for human biology, how ventilation is provided, and how to protect the exterior of the houses from moisture and wind can be a source of inspiration. Many engineered solutions are being developed to mitigate climate-related risks, such as early warning systems and crop monitoring. However, local solutions that have been developed thousands of years in the past against the changing characteristics of the natural environment, the best of which have survived to the present day, should also be explored and adapted to the present day. Solutions to today's problems can be developed by feeding on the countryside. For this, the continuity of local values must be ensured.

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# Cooperation for Climate and Green Deal Book

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