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Regulating Ecosystem Services

In the past, people prioritized the supply and cultural offers of nature. In view of accelerating climate change, however, the focus is increasingly on regulating ecosystem services. The (self-)regulation of ecosystems is ultimately also a prerequisite for their household and basic functioning. This is the only way to safeguard all other services, especially the provisioning services. In this respect, the regulating services actually deserve the greatest attention and to do so ecosystem-based climate change adaptation is of utmost importance.

Regulation of the energy balance

The formation of plant biomass and the enlargement of the surface area of all green leaves strengthens the capacity of ecosystems to convert and store light energy. This thermal mass can warm up and cool the environment as well as damp fluctuations). Neighbouring ecosystems often influence each other: water bodies and forests cool themselves and their surroundings. Cooling air flows from areas where fresh air originates via cold air paths to other areas, especially in settlements. In cooler, buffered and more humid ecosystems, the risk of extreme energetic events such as forest fires decreases. The efficiency in dealing with additional incoming energy increases in more mature ecosystems rich in biomass.

Regulation of the water balance

Mature ecosystems rich in biomass retain water particularly effectively and contribute to their own humidification. Especially in drought periods, but also during heavy rainfall events, the ability to trickle, retain, store and slowly release water is of great value. Important factors for the effectiveness of ecosystems in this case are also biomass and the structures or organic matter formed from it in soils. Reduced surface runoff and reduced flow velocity are also important for the prevention of water erosion. The corresponding regulating services are often provided across ecosystem boundaries (e.g. water flows out of the forest into open land). Structurally rich and humid vegetation also seems to attract precipitation - a typical positive feedback in ecosystems.

Regulation of the mass balance

Mature, functioning ecosystems also reduce losses of critically needed substances, e.g. by root systems and soil-covering vegetation slowing wind drift and leaching. The interaction of vegetation and soil-forming organisms with the soil also promotes the purification of water. Above-ground vegetation can have a filtering effect both on the input of substances (e.g. harmful substances) and on the discharge. Corresponding barrier and filter effects of substances and dust particles become particularly relevant in very dry conditions and in the case of uncovered soils.

Regulation of the interplay of species and biological control

Mature ecosystems with native communities and a large structural diversity are characterised by a strong biological regulation, i.e. the mass reproduction of individual species and the strong occurrence of non-native invasive species are rather suppressed. This is of great importance in terms of pest and disease control and prevention in agriculture and forestry.

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Microclimate

The weather, which results from large climatic conditions in specific locations, is influenced by a variety of properties such as the nature of the land surface and the vegetation. For example, steeper southern slopes are warmed more by prolonged exposure to sunlight, shady northern slopes are cooler, and lower basins or depressions in the terrain may accumulate colder air masses. Valleys and hills influence the climate just as much as forests and water bodies.

Satellite-based remote sensing data for the reflection of heat radiation now make it possible to estimate surface temperatures worldwide. Taking into account information on land use, water vapour in the atmosphere and cloud cover, the temperature can be determined with a resolution of 1x1 kilometre. The map shows selected data on the long-term summer average temperature (June – July - August; only daytime).

Clear temperature differences of up to approx. 7 °C can be observed. The spatial temperature patterns are not coincidental, but are clearly related to properties of the land surface. The coolest spaces are the water bodies as for example in the area of the Desna, whose course is to be recognized clearly from north to south. The heat poles of the region are located in the settlements. The so-called "heat island" effect in cities has been well known for a long time. On hot days, heat stress is particularly severe for people, animals and plants in settlements. Accordingly, it is important that cool air can flow in and that cooling areas are also taken into account in urban planning.

There are various mechanisms that contribute to cooling in the landscape. Dense vegetation literally shades itself; water bodies and biomass containing water can absorb certain amounts of heat and contribute not only to cooling but also to buffering temperature fluctuations. In productive vegetation, the conversion of light energy into biomass and the evaporation of water are also important factors for cooling. Cooler temperatures and lower fluctuations also mean higher and more balanced humidity and a reduction in heat stress. Richly structured landscapes regulate their own microclimate to a considerable extent and thus secure their own living conditions.