

ENVIRONMENTAL INFORMATION: KNOWLEDGE EVIDENCE IDENTIFICATION

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ЭКОЛОГИЧЕСКАЯ ИНФОРМАЦИЯ: ИДЕНТИФИКАЦИЯ ДОКАЗАТЕЛЬСТВА ЗНАНИЙ

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The aim of this paper is to give a general overview on our environmental and how we can they described in the broader sense. By this means the question arise, what is our environmental, and which kind of information are needed to characterize it. Until the industrial revolution the information about the environment was descriptive and documented in different way, sometime it was handed over by spoken words from generation to generation. By going forward in time assessing and determining of certain parameter take place. These parameter can only give a rough overview of the real world. On the other hand it gives the mankind the possibility to manage the takes. In the modern world Scientists and Engineers play a major role, and nearly all of them deal with environmental information, which are gained by observation and measurement. Our environment is complex conglomerate, different approaches are need to capture it as a whole. The simple way are data, these can be gain by observation, or by measurement. Furthermore detailed investigation of certain subjects or areas give a deeper look insight the environment. It has to be noted, that our environment is not a static system at all. Therefore this have to be in mind, if it goes to setup monitoring programs. An another point is to make clear that the investigation and their result follow the argument. To gain the best results of the collected data, observation and investigation it is wise to established this knowledge in regulation and directives. The main scope this paper are to give a general overview how environmental information are used by different communities and organization, either for planning or protection the environment. For example it helps authorities to plan and established certain projects. But these projects could interfere the environment. For these reason environmental awareness have to taken into account.

Keywords: environmental information, knowledge, engineers

Цель статьи — дать общее представление об окружающей нас среде и о том, как она может быть описана в широком смысле. Таким образом, возникает вопрос, что представляет собой наша окружающая среда и какая информация необходима для ее характеристики. До промышленной революции информация об окружающей среде описывалась и документировалась различными способами, иногда она передавалась из поколения в поколение в устной форме. Продвигаясь вперед, можно оценить и определить некоторые количественные параметры. Эти параметры могут дать лишь приблизительное представление о реальном мире. С другой стороны, это дает человечеству возможность управлять происходящим. В современном мире большую роль играют ученые и инженеры, и почти все они имеют дело с информацией об окружающей среде. Наша окружающая среда представляет собой сложный конгломерат, и для того, чтобы охватить ее в целом, необходимы различные подходы. Самый простой способ — это данные, которые можно получить путем наблюдения или измерения. Кроме того, детальное изучение определенных предметов или областей позволяет глубже понять окружающую среду. Следует отметить, что окружающая среда не является статичной системой, что необходимо учитывать, если речь идет о создании программ мониторинга. Еще один момент — необходимо четко понимать, что исследования и их результаты следуют за аргументами. Для получения наилучших результатов от собранных данных, наблюдений и исследований целесообразно закрепить эти знания в нормативных документах и директивах. Основная цель статьи — дать общее представление о том, как экологическая информация используется различными сообществами и организациями либо для планирования, либо для защиты окружающей среды. Например, она помогает властям планировать и реализовывать определенные индустриальные проекты, но они могут наносить и значимый ущерб окружающей среде. По этой причине необходимо учитывать экологическую осведомленность.

Ключевые слова: экологическая информация, знания, инженеры

*«When you can measure what you are speaking about,
and express it in numbers, you know something about it,
when you cannot express it in numbers,
your knowledge is of a meager and unsatisfactory kind...»
Lord Kelvin*

Foreword

The paper is devoted to commemorate professor Stanislav N. Glazachev. It is a great honor for me to con-

tribute to the journal. I meet Stanislav Glazachev during a conference at the Near East University, Northern Cyprus in the year 2007 and I was very impressed about his presentation and erudition. A couple of years later I was invited to a conference in Moscow and I met him again. During the gathering we had a nice conversation and we shared our memories about our previous meetings and knowledge regarding ecology and ecological culture formation. As his main subject is ecological pedagogy, which has in the

broader sense nothing much in common with Engineering at all. Nevertheless, this is very general spoken. The fact is that nearly all environmental issues have to deal with data, direction and regulations. In other words information about the environment, which have to be clear and logical for their user. With the growing environmental awareness more and more environmental knowledge have be transported to public. Therefore the technical and scientific knowledge is no longer a business of a small group.

Introduction

Our environment is very complex system with multi branched proportion of physical, biological, chemical and geological components. All these parts are bond and engaged in different ways to each other. Special roles play alpine and mountain areas and all kinds of water part with its different appears such as coastal areas with estuaries and tidal rivers. These components are have one in common, which is the potential danger of its natural behavior. Meteorological condition can causes avalanches, debris flow and flush floods are typical in mountain areas. Therefore the human society established simple tools to measure and observe nature phenomenas and environmental events. Even in coastal areas the reading of water height on tidal rivers and shore line toke place quite early. One of the main reason was to warn people for natural events. With the industrial revolution more and more information on the environment was required. Information was also necessary for development of infrastructure such railways, tunnels, motorways, industrial plant and housing, just too mention few of them. All these activities take place in an highly complex and in some parts very sensitive environment. To make sure that all these impact into the environment has no adverse or minimal effect on the environment, different regulation have to be taken into account. To established rule and directive different information are needed. To set down regulation sufficed knowledge about the subject and the area of investigation are required. In most case the knowledge are observed and measured data.

The Environment

Nowadays the word environment is ubiquitously, but what does it really mean.

The Merriam-Webster Dictionary explains as following:

- The circumstances, objects, or conditions by which one is surrounded,
- The aggregate of social and cultural conditions that influence the life of an individual or community.
- The complex of physical, chemical, and biotic factors (such as climate, soil, and living things) that act upon an organism or an ecological community and ultimately determine its form and survival.

After The Cambridge Dictionary, it clarifies like these:

- A set of surrounding conditions, especially those influencing development or growth,
- The air, water, and land in or on which people, animals, and plants lives.

In German language the environment called Umwelt, and ist defined in the same way as mentioned above. The danish poet and translator Jens Immanuel Baggesen (1764–1826) used the word Umwelt [1] in the setting reading people who surround the poet in the year 1800. In the background of natural science is was firstly used by Jakob Johann von Uexküll (1864–1944) in the year 1909 [8]. By this time the term environment, which was hardly common in everyday life at the time. He found, and this was the focus of his research, that animals live in what he calls their own environment. Every animal only learns and experiences what its sensory organs and needs and instincts allow it to do. Today he is call the father of ecology. Despite his great achievements he was always a stranger within the academic community. In contrast to Uexküll, Friedrich Wilhelm Heinrich Alexander von Humboldt (1769–1859) was already well known and highly respected during his lifetime in both academical community and common public [10].

Alexander von Humboldt was a German explorer with a field of activity far beyond Europe. In his complete works, which he created over a period of more than seven decades, he created a new level of knowledge and reflection on knowledge of the world. He made research contributions to 30 disciplines, most of which are still valid today. In addition to his books, he published 750 essays. Furthermore he became a co-founder of geography as an empirical science. It is obviously that a scientist with extensive knowledge in thirteen disciplines like to be seen as the father or founder by various disciplines. The geographers call him the first of their discipline. Nowadays the scientist who work in the field of climate, pronounce him as the founder climate science. All in all he was a real multi talented scientist with profound knowledge in many areas. For both Uexküll and Humboldt the investigated the environment and gained deep knowledge. Their achievements of both would be an essay of its one and is outside the scope of this paper.

Environmental Pollution and Natural Hazard

In many countries and states, the word environment is quite often used in a detrimental context with phrases like, harmful to the environment, or clean up/improve the environment. Nearly very day newspaper and other media came out with dreadful information about the environment. For example, unidentified liquid has had a disastrous effect on the environment. The monumental disasters or catastrophes of the last five decade is still in everybody mind. The Exxon Valdez Oil Spill, the

Sandoz Chemical Spill, Chernobyl disaster just to mention few of them, they're where all terrible and disastrous for the environment, and filled the headlines for weeks.

But environmental impact with pollution is not an issue of today is it as old as the environment, or better as old as the mankind. It started with Neolithic Revolution, also called the Agricultural Revolution which was the about 12,000 years ago. During this period the live of humans change forever and set the way for modern civilization. It means that the live of hunters and gathers who roamed across the natural suddenly made a dramatic shift and became farmers and settled down. Unfortunately there is no exact dates and reason for these transition, but it is worldwide documented [4]. However, farming happened first in the Fertile Crescent, also called the Cradle of Civilization, is the region in the Middle East which curves, like a quarter-moon shape, from the Persian Gulf, through modern-day southern Iraq, Syria, Lebanon, Jordan, Israel, and northern Egypt. These Agricultural Revolution was likely a series of revolutions that occurred at different times in different places. Furthermore remarkable construction were build to store and distribute water for agricultural purpose [6]. By this means the natural landscape changed dramatically. In Ancient Times, the humans influence on its environment became even more visible. The Romans and Greeks cut down huge areas of wood for shipbuilding and for fuel to smelt metals. The landscape of the Mediterranean change dramatically, some areas became karstic. The Roman Empire was the most extensive political and social structure in western civilization. Under Caesar, the Romans established an environmental law for polluted water. Anyone who maliciously polluted water had to pay a fine. Similar regulation took place in Central Europe, after vast areas of the Black Forest where cut down for coal mining and other reason. Solid waste and waste water problems, caused by tanners, butchers and dyers polluted drains, rivers and catalyzed a stench in the medieval towns that was almost unbearable for the residents.

With the Industrial Revolution, which took place in the period from about 1760 to 1840 more and more dramatic changes happened. Working life in rural and urban settings was changed forever by the inventions of new machines, the spread of factories, and the decline of traditional occupations. More and more goods were produced by machine instead by hand, and became affordable to more people. On the other hand the price for these progress was often very hard working life, noisy, and dangerous, towns and cities grew rapidly, become overcrowded and polluted. As a results of these a widespread epidemics of infectious diseases like cholera, typhoid, typhus, smallpox, and tuberculosis took place.

The waste from the factories, which use water for their processes was an unpleased side effect and just spilled away. Even the exhausted gases from industrial companies, damaged forest near by. In order to dilute the exhaust gases from industrial companies, high chimneys were already prescribed in the middle of the 19th century. By 1900,

numerous rivers were dead because of untreated industrial and domestic sewage being discharged. At this time, there was no question of Environmental Awareness. Very slowly, thinking of Nature Conservation started and take shape.

Beside headline of environmental disasters, as mentioned in one of the first sentence of this chapter, there are also many news about Natural Hazards. Earthquakes, Volcano eruption, Tsunamis, Storm Surge and Floods, can cost lives and destroy huge areas. One of the notable event in the year 2004 with the lost of 230000 souls was the undersea earthquake in der Indian Ozean, caused a tsunami in Sumatra. 1.7 million people lost the homes. The Tōhoku — Earthquake in 2011 was the strongest undersea event on the Sanriku — Coast within the Japan's region Tōhoku. About 600,000 inhabits were affected 3.5 per cent of them lost their life. The Magdalenen flood of 1342, also known as the Magdalenen flood, was a devastating flood that hit the surrounding areas of numerous rivers in Central Europe. The name goes back to the then customary naming of the days according to the calendar of saints, here on St. Magdalene's Day on July 22nd. During this flood, the highest water levels ever recorded were reached on many rivers. Maybe it was the worst flood of the entire 2nd millennium in Central Europe. O. Baensch [2] described meticulous the catastrophic storm surge in the Baltic Sea on 12nd and 13rd November 1872. During this storm the water level was 3.30 meters above of the mean water level in the western part of the Baltic Sea. This flood event is proven to be the most severe storm surge in the western Baltic Sea. The impact on people's lives and those around them was devastating. Beansch's paper explained very detailed the whole complexity of the meteorological condition of the total Sea including all parameters like air pressure, wind direction from all station around. It can be stated that his report is a comprehensive report of this catastrophic event, bad also a important source of environmental information.

More recently, the Oder flood of 1997 was the largest known flood of the Oder. It caused severe damage in the Czech Republic, Poland and Germany and claimed many lives. On the 7th of August 2023, CNN (2023) reported that devastating floods and other adverse weather conditions in Slovenia have killed at least six people and caused \$500 million worth of property damage [5]. Slovenia's Prime Minister Robert Golob said on Saturday the flooding which began on Friday has become the ,worst natural disaster to ever hit' the country. The floods caused rivers to rise and break out into fields and towns, leading to the destruction of roads and infrastructure. The severe weather conditions in southern Europe caused an another flood in Greece, just a month later.

In this context, the Hunga Tonga–Hunga Ha'apai (HTHH) eruption in January 2022 [3] cannonaded a mixture of ash, gas, and pulverized rock into the sky, like during every volcanic blowup. But this eruption contained one addition load of 146 megatons of water from the underwater caldera into the stratosphere like a geyser.

After S. Jenkins et al. (2023) is the potential contribution to atmospheric warming over the next 5 years [7]. By this means, the large water vapor perturbation means that НТНН will probably increase the net radiative forcing, unusual for a large volcanic eruption, increasing the chance of the global surface temperature anomaly temporarily exceeding 1.5°C over the coming decade.

The list of man made pollution and natural hazards could be continued and explained and described in detail. However, the above mentioned perils shows that not only mankind products cause danger, even natural events cause catastrophic circumstances. It is worth to stress, that these natural hazards would cause likely more devastating if they would happen today.

Environmental Data and Regulation

Since ancient history mankind used information of the environment and in different ways. Even nomads used simple information for their animals to find the right place with adequate condition. They did this by their instinct, without knowledge of any kind of environmental information. They observed the nature with all its benefits and danger. They needed because it was very significant for their life. After settlement and with the beginning of civil society facts and findings were written down in historical books. Simply speaking the vehicle 'Environmental Information' deals with facts and data in the use of daily business. Beside the detrimental issue of man made pollution, which is definitely not to denied, the hazards from disagreeable atmospheric conditions and sudden geological activities are the mostly used issue of information. The meteorological condition plays a special role. Either sunshine or rain and how are the temperature. All these data are provided by meteorological authorities. They operate a network of weather station and other facilities. Data and facts are provided via data bank for everybody. Metrological information like e.g. precipitation, evaporation or sun radiation are characteristic elements of the hydrological cycle. This cycle is well explained in every hydrological text book for example E.Shaw [9] and is one of the mostly used environmental information. Therefore it is briefly described in the following paragraph.

The hydrological cycle near the earth surface can be described as a circulation from ocean water which evaporate by sun radiation. Hereby the water changes from the liquid to the gase state. It remains in the gaseous state for about 10 days while it is part of the atmosphere. With the process of condensation to form clouds to water vapor the water change its state back to the liquid state. Depends on the atmospheric conditions precipitation as rain or snow will be produced. This precipitation return to the ocean storage directly or it takes amore devious route to ocean via land surface. Snow may accumulate in Polar regions or on high mountains and consolidate into ice, in which state water is stored naturally for long periods. In more temperate lands, rainfall may be intercepted by vegetation from

which the intercepted water may return at once to the air by evaporation. The rainfall which reaches the ground may collect to form surface runoff or it may infiltrate into the ground. The liquid water in the soil percolate through unsaturated layers until it reaches the water table where it becomes saturated, or it will be taken up by vegetation from which it may be transpired back into the atmosphere. The groundwater flow and surface runoff join together in surface streams and rivers where it is held up temporarily in lakes but finally flow into the ocean. The land phase of the hydrological cycle is very important in nature since evaporation is a purifying process; the salt sea water is transformed into fresh precipitation water and therefore water sources and storages on the continents consist mainly of fresh water. Groundwater storage with dissolved salts (brackish water) and surface water polluted by man or natural suspended solids are the exception. This general and brief description of the hydrological cycle gives a first impression of the hydrological information and therefore one of most important the environmental information too. The various interconnected reservoirs of the Earth such as atmosphere, water, soil, sediments and biota contain material that are identified by high ratios of area to volume. Within the hydrological cycle many other processes taking place either natural or manmade.

All these processes mentioned above can only give an impression of the ongoing processes. However, it is easy to imagine, that all these processes have to be investigated for different reason. As mentioned above the core issues are data and any kind of information. Due to the complexity and different processes huge amount of various subjects and data are involved. To address all these information, different regulation are required to get highly quality data. Furthermore these data have to be comparable to achieve reliable results. Because they are the base of all kind of human civilization e.g. design and planning of infrastructure. Subject based regulation make sure, that all gained data and information are in the correct quality. In the light of this paper it is not feasible to specify all rules, standards and regulations. By looking on one of the major object of natural hazards, meteorology plays are major rule. Therefore the following paragraph will give an impression of the rules and regulation to observe and gain meteorological parameters.

The International World Meteorological Organization (WMO) was established in 1873 and is the international standardization organization in the fields of meteorology, hydrology, climatology and related environmental disciplines [11]. Their technical regulation consist of standard and recommended practices and procedures adopted by World Meteorological Congress for universal application by all Members. Furthermore, there are regulatory provisions, which make it sure to operate global observation systems around the clock (24 hours per day, 7 days per week and 365 days) for observations, data exchange and management, forecasting and provision of authoritative scientific assessments

and standardized service products to a variety of users in each WMO Member State and Member Territory [11]. These technical regulations are based on necessities and designed to bring efficiency and interoperability. Such as to support policy and decision-making in many field and sections of disaster risk management, agriculture, water management, public health. All these technical vehicles are relay on exact and precise observation of data. The technical regulations of the WMO include manuals, which contain detailed thematic regulatory. For example how to choose the right place to establish measurement. The takes place in a Stevenson Screen a box shape shelter, double-louvered design and white painted, because white in color to reflect direct solar radiation. The standard for the height of the thermometers is between 1.25 and 2 meters above the ground. Beside the thermometers, there are following instruments included, a hygrometer, a psychrometer, a dew-cell, a barometer, and a thermograph. Another important point is the siting of the weather station, which is very important to avoid data degradation by the effects of ground cover, buildings and trees. Nowadays temperature readings are gained by remote sensing like satellites, but these information cannot be compared with data from Stevenson Screen, because satellite information collected the data from the surface and not in the height of 1.25 or 2 meters above the ground. It is worth to mention, that the screen original was designed by Thomas Stevenson, a Scottish civil engineer and was the father of Robert Louis Stevenson, the author of the novel the Treasure Island.

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There are many other aspect on measurements of meteorological parameters. The briefly described procedure of requirement on instruments and side stands for all the other environmental parameters.

Summary

This paper faces expressions which is quite often used in daily business. But what do they really mean? The aim was to bring some clearance into the whole matter. As mentioned in one of the first paragraph, that this paper can only give a general overview on our environmental and how we can they described in the broader sense. Furthermore, it also does not claim to be full fit all aspects of environmental expression and issue. However, it can be stated due to the complexity of our environment that a general glance on our environment gives not the right answers. A meticulous approach in all directions is necessary to obtain to right impression. The observation and measurement of data are only on aspect. Choosing the right side for observation can be a challenge. In this context, there is one thing to stress. As human activity never stops by building up infrastructure. The once so carefully established side for a weather station can be influenced by e.g. a tree or a tall building. Furthermore the language of the regulation and directive have to be absolute clear and unmistakable. Depends on the area of investigation, and the important of the project, it could be useful to start a deep literature research, because not all information can be drawn from collected data.

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