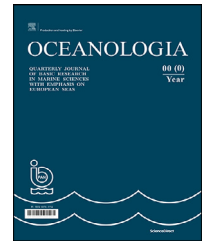




Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.journals.elsevier.com/oceanologia



ORIGINAL RESEARCH ARTICLE

Climate and aging. Selected aspects from the psychological perspective

Henryk Olszewski*

Institute of Psychology, University of Gdańsk, Poland

Received 6 February 2020; accepted 10 April 2020

Available online 18 May 2020

KEYWORDS

Climate change;
Psychology of aging;
Climate anxiety

Summary The main focus of my research lies within the psychology of human development, especially in late adulthood. There are many reasons why psychologists are interested in climate change. One of the fathers of modern medicine, Hippocrates, proclaimed that the climate affects the mood (liquids) existing in the human body. I wrote an article about climate change and its relationship to the psychological functioning of people in old age. As we enter adulthood, the new generation will severely experience increasingly extreme weather events. Already this phenomenon is more frequent than several decades ago and takes a deadly toll. Heat waves will be more frequent and so the children and older people will be often exposed to that phenomenon. It may have a detrimental effect on those in the declining period of their lives. In my opinion, an important question is to what extent modern living should (in a moral sense) limit the current consumption of many goods because of the duty to care for the standard of living and its quality and the interests of people who will live in the future.

© 2020 Institute of Oceanology of the Polish Academy of Sciences. Production and hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Climate crises, which recur in varying intensity every dozen, several dozens, several hundreds of years, as much as today, affect the evolution of species, including the evolution of *Homo sapiens* and its civilization. Through the processes of adapting species to a changing living environment (suffering, stress invoking organism adaptation to the environment), nature has led to, inter alia, an improvement of the human brain and to the creation of the *homo sapiens* society and civilization. Human society, as a result of joint actions,

* Corresponding author at: Institute of Psychology, University of Gdańsk, Poland.

E-mail address: henryk.olszewski@ug.edu.pl

Peer review under the responsibility of the Institute of Oceanology of the Polish Academy of Sciences.



Production and hosting by Elsevier

<https://doi.org/10.1016/j.oceano.2020.04.003>

0078-3234/© 2020 Institute of Oceanology of the Polish Academy of Sciences. Production and hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

has freed man from the total dominion of nature. It can be said that our world is perfect because we perfectly adapt to it in the process of evolution. Humanity has developed the ability to become independent of the natural environment, an ability to produce food and energy. However, environmental changes, such as climate change, periodically caused a decrease in the food supply, which could sometimes exceed the adaptability of the human population. This often led to the diversification of human groups driven by instinct to wars over areas rich in food. The development of civilization, including food production methods, has allowed for a rapid development of the human population. In addition to nature, in effect the society has also become a human environment, providing various means of life and possibilities of individual development. All individual human activities within a community result from knowing the needs of the entire human community. Society, through the development of individual specialization and the opportunity to exchange information, has developed the knowledge necessary to rule the environment. However, new abilities solely to meet social needs have become necessary. Thus, socialization can be considered a form of adaptation to social requirements. All human activities are focused on meeting social needs. The aim of people's individual wishes is often some common social good, while the aim and the highest good for people is harmonious coexistence in society. In other words, the aim of society is harmonious existence in the natural environment as well as the development of knowledge about it, which is required to create a new world (Wilson, 2003).

Prevention of climate changes caused by human activity may soon affect human life. This applies to heat waves and floods that can take many lives and, consequently, cause famine, disease and migration. According to the vast majority of scientific theories, people are not accidental passers-by on Earth: it is people who by using cars, electricity and, generally speaking, the benefits of civilization, contribute to climate change. However, people who do not take climate change seriously should remember about their obligations towards future generations. An important question is: what and to what extent should modern man sacrifice from his own welfare to prevent climate change?

According to the Stern Report of 2006 by the British government, the estimation of the costs of climate change has led to the conclusion that governments should spend about 1 percent of global GDP per year on combating global warming (in 2006 it was approximately 500 billion USD) because it simply pays off. However, if this money is not spent now, then in the future – in 20 or 100 years – the costs that humanity will have to bear due to climate change will be significantly higher. Moral obligations to future generations are just as real as to those living today, even if we do not have yet relevant tools to compare the interests of people living in distant times (Żuradzki, 2020).

2. Discussion

There is a thesis that people living today should (in a moral sense) limit the current consumption of many goods out of the duty to care for the standard of living and interests of those who will live in the future. The practical effects

of the problem can be demonstrated through the example of setting greenhouse gas emission limits, the issue that is currently being debated. It is now widely accepted that the emission of greenhouse gases into the atmosphere is an important factor in global warming. Even slight global warming can significantly effectuate the consequences for people who will live in the future. Firstly, extreme weather such as hot weather, floods, storms, etc. – can kill many people, and e.g. deprive others of property or shelter. Secondly, various tropical diseases, e.g. malaria, will result from rising temperatures because insects, vectors of malaria are performing better in high-temperature environments. Thirdly, changes to the amount and frequency of precipitation can lead to drought and food shortages, as well as to floods, which in turn will harm agriculture and significantly reduce access to clean water. In addition, climate change can have many other indirect adverse effects, e.g. it can contribute to great migrations which will start when the seas and oceans flood lower land areas, which in turn may lead to armed conflicts (Bromme, 2008; Żuradzki, 2010; Żuradzki, 2015).

A changing climate will transform all aspects of life. Tens of millions of jobs are already disappearing because of the heat that prevents working outside. Droughts, floods and other climate change effects will negatively affect agriculture, which can contribute to food shortages. Children, especially in the countries of the global South, will be at risk of malnutrition. The range of tropical diseases that will reach Europe will change. Currently, the number of fire incidents is increasing in 3/4 countries of the world. Deteriorating conditions can cause unprecedented migrations and armed conflicts over water and other resources. Warming will contribute to the extinction of species, and scientists are already talking about the sixth mass extinction. Upon entering adulthood, the new generation will experience and be severely affected by increasingly extreme weather events. Today this phenomenon is already more frequent than several decades ago and takes a deadly toll. Heat waves, by which children and the elderly will be more and more affected, will be more frequent and stronger (Strzałkowski, 2019).

So far, the spectacular measure of the progress of past eras has been the extension of the average life expectancy. Demographic forecasts for the next decades show that the observed aging process in societies is progressive. Nowadays, this parameter, without losing its attractiveness, directs civilizational health standards based on qualitative, not just quantitative criteria. The widespread extension of human life today and old age place medical sciences and social services face to face with new challenges, in particular systemic changes that are necessary and difficult to implement, on a scale previously unknown in history. On February 3, 2009, the European Parliament listed demographic problems among the three main tasks for Europe alongside globalization and climate change (European Parliament, 2009).

Aging is an inevitable, irreversible and one-way process. It cannot be reversed but can be slowed down. There are several stages of aging that lead to the terminal phase in the life of an organism. Life expectancy and speed of aging are determined by a genetic factor (long-lived parents have long-living offspring), but not only. The fundamental genetic program of an individual can also be affected by environ-

mental and individual factors, individual mental characteristics, conditioning the individual's biography. The search for answers to the question concerning longevity has initiated many studies on the environmental and personality conditions of older people (Mamak-Zdanecka, 2015).

Below is shown the correlation of life expectancy with the physical and social environment:

Okinawa. An important factor was the diet consisting of low-calorie, sweet potatoes, green and yellow vegetables, soy products, fish, small amounts of meat, tofu. The sense of meaning in life was also important for the length of life.

Sardinia. Factors such as pastoral lifestyle and simple dishes (whole-grain fritters, tomatoes, garlic, olives, broad beans, sheep's cheese, local red wine with strong antioxidant properties) have been indicated. The term "blue zones" was adopted by demographers who are studying just a group of hundred-year-old residents of Sardinia.

Loma Linda. The life expectancy of 8 years compared to residents of other US states was associated with socio-cultural factors. Residents, followers of the Seventh-day Adventist Church, follow the rules of religion – abstinence from alcohol, drugs, vegetarian diet and the Sabbath (leaving one day a week just to rest).

The Nicoya Peninsula. The main reason was seen in the climate and physical environment. A favorable, dry and warm climate and water with the high calcium content. In addition, papaya fruit is often an ingredient in the residents' diet, which in addition to antioxidants contains nicotinic acid regulating cholesterol levels.

Ikaria. A high percentage of residents living up to 90 years (1/3 of the community) was recorded. The diseases that are most responsible for shortening life expectancy are cancer, cardiovascular disease, senile dementia, which are very rare among this population. Active life, a diet based on whole grains, fruit, goat milk rich in tryptophan and regular rest during the day were indicated as factors favoring longevity (Wróblewska, 2012; Mamak-Zdanecka, 2015).

Bearing in mind the above correlations, demographers introduced the term 'blue zones' in order to study the correlation of above-average life expectancy with external environment and lifestyle factors. These zones include Okinawa in Japan, Sardinia in Italy, Loma Linda in California, the Nicoya Peninsula in Costa Rica and the Greek island of Ikaria. One of the high-profile cases of inference about long-lived communities – was the study of the inhabitants of Georgia during the period of belonging to the USSR, among which there was a very high percentage of centenarians. Conclusions regarding the genetically determined longevity of life and behavioral factors of Georgians turned out to be false. In fact, older Georgians used their parents' birth certificates to avoid being incorporated into the Soviet army, adding to their calendar age between 20 and 30 years (Kirkwood, 2005; Mamak-Zdanecka, 2015; Stuart-Hamilton, 2006).

There are several reasons why psychologists are interested in climate change. One of the fathers of modern medicine, Hippocrates, proclaimed that the climate affects the humours (liquids) existing in the human body: blood, bile, mucus and black bile, which translate into personality. In turn, the Roman architect, Vitruvius, whose work inspired Leonardo da Vinci, claimed that geographical and climatic conditions affect people's diligence and character. Psychol-

ogy as a science discipline observes with concern the undermining of the role of science and building distrust of scientists by those who claim that global warming is not true. Social and environmental psychologists study interactions, i.e. the mutual influence of man and the environment. It should be remembered that it is a man who, through his own decisions, contributes to the climate crisis, which impacts back on the man. Third, psychologists study attitudes, their origins, and how they affect behavior. The concept of 'climate anxiety', or 'climate depression', functions in psychology. This term is understood to be a chronic fear resulting from fear of annihilation, which may be a consequence of the climate crisis. This fear is related to the fear of the collapse of social structures, war, hunger, economic crisis, and the destruction of the world. From a psychological point of view, this can result in symptoms such as insomnia, a sense of meaningless life, and tormenting thoughts about an impending disaster. As a result of these symptoms, various life decisions made by a person can be impacted (e.g. not having children). In such a situation, it is difficult to talk about depression or climate anxiety in the disorder category, because the anxiety has adaptive properties, as it warns about a threat, allowing survival and motivating to act. The problem is too high anxiety, paralyzing anxiety, disorganizing action or 'non-adaptive fear'.

Until now, man has lived in the belief that thanks to the development of science and rapid civilizational and technological changes every next generation will live better. Currently, however, we are not so sure. This awareness that the next generation will live in a world of crisis and anxiety can keep you from deciding to enlarge your family. On the other hand, we are dealing with an overpopulation crisis, which is why such decisions can be an expression of ecological awareness (Jaśkiewicz, 2019).

In a special way, all changes, especially those related to the environment, affect the elderly, who upon starting their retirement should create particularly favorable living conditions. This is often associated with a deterioration of the socio-economic situation, which may reduce the motivation to achieve and strengthen the need for security and peace. Listed below are elements of the elderly's situation, both those that make up the picture of all life inconveniences, but also attempts to answer in the form of adaptive behavior. It should be noted that people in late adulthood may experience fear of loneliness and rejection (Straś-Romanowska, 2007). Therefore, for some older people, old age can be a period of crisis that is strongly associated with environmental determinants (place of residence, getting used to the geographical and natural environment, climate, etc.).

Experienced crises can be understood as difficult situations that can trigger various strategies to deal with them. According to P. Oleś, these strategies are associated with personality maturity (Oleś, 2000). In his opinion, when choosing a strategy to deal with difficult situations, man is guided by the cognitive assessment of the situation understood as the primary assessment, and his own ability to cope with the difficulties experienced as the secondary assessment. A person affected by a crisis can interpret their problems in terms of challenges and then it will trigger the so-called active ways of coping, but if a man interprets the crisis as a loss or threat then strategies may appear that

reduce those unpleasant emotions. In the cognitively oriented concept of R.S. Lazarus and S. Folkman, the choice of active strategies (when experiencing crisis as a challenge) can be attributed to people with the so-called mature personality, which cannot be said about individuals who interpret experienced stress and life problems as phenomena and situations with 'no way out', resorting to the use of defense mechanisms. In both possible variants, the importance of mature personality (psychological maturity) in the selection of adaptive mechanisms is clearly drawn (Olszewski, 2003). It is particularly visible in the period of old age, when the last period of life depends to a large extent on how a given older person deals with crises of this period. It can be assumed that the life experience, attitudes that have evolved during life, will bear fruit and they helped in the choice of strategy, but it may be that the negative traits coexisting with senile crises will be stronger and they will dominate over the active search for optimal solutions, ultimately affecting the quality of adaptation processes (ibid., p. 45; Dyczewski, 1994).

The difficulties and crises experienced by man trigger defensive activities, thanks to which emotional tension is reduced without changing the stress reality (Lewicki, 1972). These are "unconscious and habitual techniques used to deal with tension and anxiety, which are aimed at reducing anxiety and causing substitute satisfaction of needs. At the same time, defense mechanisms, in addition to the positive function of defense against fear, also have negative properties. The man who uses them distorts information about the world and also distorts knowledge about himself, which is the reason for further mental disorders" (Sęk, 2001). The consequences of using defense mechanisms can be destructive or constructive. Destructive ones include symptoms leading to psychosomatic diseases (asthma, stomach ulcers), loss of objectivity, excessive defensive attitude, lowering insight into one's personality resulting in less self-understanding, development regression, and increased neurosis. Constructive, desirable consequences may include new, positive character traits, emotional balance, positive health, finding consciously accepted substitute goals. These consequences are most desirable for building a high level of quality of life in old age (Płużek, 1991).

Quality of life is a very complex construct regarding human expectations, exploring both the subjective and objective aspects of life from the point of view of a human or social group (Ratajczak, 2005). Essential to psychology is this subjective aspect of the quality of life because it reflects the mental states that occur in the process of satisfying needs and achieving important goals. "These states are the result of a cognitive assessment of the relationship between man and the environment, with an assessment of their own achievements and failures, in their own struggles with the environment and an assessment of the chances of achieving their own aspirations, desires and life goals" (ibid. p. 236). In psychological studies of the quality of life of people over 60 years of age carried out by Brzezińska (Brzezińska, 2000; Obuchowski, 2002), they were asked to assess the satisfaction of five groups of needs, i.e. safety, relationships with people, doing things for others, activity and work, leisure and free time. Studies have shown that four out of the five categories showed the highest declared quality

of life. Only in the safety category was the quality of life poor.

The implementation of a development task, which is to create favorable living conditions that take into account environmental conditions, is important for the subjective sense of the quality of one's own life, which can be understood as physical, mental, material and social well-being. The perceived quality of life is influenced by assessing your own productivity, satisfaction with social contacts and meeting your needs. When the tasks faced by people of a certain age are carried out successfully, then their life satisfaction increases (Raeburn and Rootman, 1996), i.e. a global assessment of the whole life according to the criteria chosen by the individual (Shin and Johnson, 1978).

Some socio-territorial indicators, such as gross domestic product and economic resources, contribute to the environment, and individual assessment of this environment may affect the quality of life of the people who live in it (Hawthorne et al., 2006). Studies show a link between a place of living and physical and mental health (Kawachi and Berkman, 2003). The quality of life of people living in an area may be related to a sense of community with the area and the community that lives there (Wen et al., 2006). The inhabited neighborhood has a multidimensional impact on health through living and landscape conditions, a sense of belonging to the community and attachment to the place, and climatic conditions (Kagan et al., 2011). Many studies show that the correct relationship of a person with his life environment correlates with well-being, allows you to feel at ease, gives you a sense of trust and security. Few people change their place of residence during old age. However, maintaining social continuity and the physical environment is an important element of optimal aging (Atchley, 1999). Studies confirm a stronger attachment to the place and living conditions of people in late adulthood. The reason for this may be that with age, the period of residence in a particular place usually increases. It should be assumed that both neighbors one knows, as well as friends or sellers in stores, give the elderly a sense of security and stability, which they need especially during this period of life. Despite the fact that you do not enter into close relationships with them, they allow you to believe that if such a situation arose in which you needed the help of the community, someone would provide this support.

Elderly people develop a sense of continuity and the prospect of changing the environment and living conditions could be very unfriendly for them. It is also associated with an increased sense of need for security and a focus on stability in people in late adulthood. Stronger attachment to the place by people in late adulthood may, therefore, result from the specifics of this development period and relevant development tasks. Robert Havighurst (1972) indicates that the period of late adulthood is characterized by adaptation to biological and social regressive changes occurring at that time, then physical forces may decrease, which may result in less mobility. Social contacts with people of a similar age and adopting appropriate new social roles, such as the role of grandmother or grandfather, are particularly important for these people. Forming social bonds with peers and new family members not only increases life satisfaction but can also be a factor deepening attachment to the place they live in and to the conditions of their own life

(Mandal and Latusek, 2015). The role of attachment to the place of residence increases with age, which is why older people maintain a sense of continuity in their lives, and the past, which took place in the same area, provides memories in the same conditions and may seem alive. This subjective feeling of permanence and lack of changes can also protect older people from a sense of the passage of time, a sense of dependence on others or a decrease in certain skills (Rubinstein and Parmelee, 1992; Mandal and Latusek, 2015).

It should be noted that weather changes have a significant impact on the appearance of various ailments, such as headaches, joint aches, muscle aches, excessive sweating, breathing problems, palpitations, impaired concentration, irritability, anxiety, low mood, depression. People with chronic illnesses may experience an exacerbation of the above conditions. It is recommended to make simple changes in the daily life of seniors to improve the comfort of daily existence and reduce the risk of serious complications or events. In this regard, it is important to ensure a proper diet and regular physical activity.

3. Conclusions

Awareness of the role of global warming and climate change in the daily lives of Europeans, including seniors, has been the subject of a separate European Investment Bank study. As for Poles, 40 percent do not think climate change is a threat to humanity, with the European average half as much, and this differs significantly across age ranges: 34 percent of younger respondents aged 18 to 34 are of the opinion that climate change is a danger, and in the older age group, 35–54 years, this percentage increases to 48 percent. Research shows that in most countries of the European Union the opposite is true. Older respondents are less aware of the threat than the younger ones, which may be related to the level of education, but also to the way they perceive these changes.

Elders generally associate global warming with more frequent and intense summer heat waves that are bothersome and even dangerous to them. On the other hand, heat is not disturbing for young people. On the contrary, they want heat waves to happen more often, so they do not perceive them as a real threat. Therefore, it is worrying that younger generations do not realize that the pollution which contaminates our air and warms our planet has accumulated for generations, and it is high time to stop this process. And although the awareness of the elderly is filled with real anxiety that falls under the crises described by psychologists, their possibilities for climate change are significantly limited.

References

- Atchley, R.C., 1999. *Continuity and adaptation in aging: Creating positive experiences*. John Hopkins Univ. Press, Baltimore, 214 pp.
- Broome, J., 2008. *The Ethics of Climate Change*. Scientific American, July 2008, 97–102.
- Dyczewski, L., 1994. *Ludzie starzy i starość społeczeństwo i kulturze*. Wyd. KUL, Lublin, 119–124.
- European Parliament, 2009. *European Parliament resolution of 3 February 2009 on nondiscrimination based on sex and intergenerational solidarity (2008/2118/INI)*.
- Hawthorne, G., Herrman, H., Murphy, B., 2006. *Interpreting the WHOQOL-Brief: Preliminary population norms and effect sizes*. Soc. Indic. Res. 77, 37–59.
- Jaśkiewicz, M., 2019. Interview. Accessed at: <https://kultura.trojmiasto.pl/Dr-Michal-Jaskiewicz-kryzys-klimatyczny-to-nasza-wspolna-sprawa-n139613>.
- Kagan, C., Burton, M., Duckett, P., Lawthorn, R., Siddiquee, A., 2011. *Critical community psychology*. Blackwell, Padstow, 396 pp.
- Kawachi, I., Berkman, L.F., 2003. *Neighbourhoods and health*. Oxford Univ. Press, New York, 320 pp.
- Kirkwood, T., 2005. *Czas naszego życia*, Wydawnictwo Charaktery Sp. Z o.o.
- Lewicki, A., 1972. *Psychologia kliniczna*. PWN, Warszawa, 491 pp.
- Mamak-Zdanecka, M., 2015. *Pomyślne starzenie się w wymiarze demograficznym, społecznym, gerontologicznym*. In: Synowiec-Pilat, M., Kwiatkowska, B., Borystowski, K. (Eds.), *Inkluzja czy ekskluzja? Człowiek stary w społeczeństwie*. WTN, Wrocław, 19–36.
- Mandal, A., Latusek, A., 2015. *Przywiązanie do miejsca zamieszkania w biegu życia*. Psychologia Rozwojowa 20 (2), 73–87.
- Obuchowski, K., 2002. *Osobowość wobec zmian cywilizacji, czyli o ludziach roli, uczenia się i autorach siebie*. In: *Kolokwia Psychologiczne*, 10. Psychologia w obliczu zachodzących przemian społeczno-kulturowych. Instytut Psychologii PAN, Warszawa.
- Oleś, P., 2000. *Psychologia przelomu połowy życia*. TN KUL, Lublin, 301 pp.
- Olszewski, H., 2003. *Starość a witaukt psychologiczny. Atrybucja rozwoju*. Wyd. UG, Gdańsk, 200 pp.
- Plużek, Z., 1991. *Psychologia pastoralna*. WITKM, Kraków, 230 pp.
- Raeburn, J.M., Rootman, I., 1996. *Quality of life and health promotion*. In: Renwick, R., Brown, I., Nagler, M. (Eds.), *Quality of life in health promotion and rehabilitation: Conceptual approaches, issues, and applications*. Sage, Thousand Oaks, CA, 75–88.
- Ratajczak, Z., 2005. *Jakość życia człowieka w warunkach narastających zagrożeń*. In: Straś-Romanowska, M., Lachowicz-Tobaczek, K., Szmajke, A. (Eds.), *Jakość życia w badaniach empirycznych i refleksji teoretycznej*. Kolokwia psychologiczne. Wyd. Inst. Psychol. PAN, 141–231, p. 236.
- Rubinstein, R., Parmelee, P., 1992. *Attachment to place and the representation of the life course by the elderly*. In: Altman, I., Low, S.M. (Eds.), *Place attachment*. Plenum Press, New York, 139–161.
- Sęk, H., 2001. *Wprowadzenie do psychologii klinicznej*. Scholar, Warszawa, 341 pp.
- Shin, D.C., Johnson, D.M., 1978. *Avowed happiness as an overall assessment of the quality of life*. Soc. Indicators Res. 5, 475–492.
- Straś-Romanowska, M., 2007. *Późna dorosłość. Wiek starzenia się*. In: Harwas-Napierała, B., Trempała, J. (Eds.), *In: Psychologia rozwoju człowieka*, 2. PWN, Warszawa, 263–293.
- Strzałkowski, P., 2019. *Kryzys klimatyczny może “przeorać” życie urodzonych dziś dzieci. Już teraz wpływa na zdrowie*. Gazeta Wyborcza 15.11.201910:02.
- Stuart-Hamilton, I., 2006. *Psychologia starzenia się*. Zysk i S-ka, Poznań, 304 pp.
- Wen, M., Hawkley, L.C., Cacioppo, J.T., 2006. *Objective and perceived neighborhood environment, individual SES and psychosocial factors, and self-rated health: An analysis of older adults in Cook County, Illinois*. Soc. Sci. Med. 63, 2575–2590.
- Wilson, E.O., 2003. *The future of life*. Vintage Books Edn., 229 pp.
- Wróblewska, W., 2012. *Długowieczność i zmiany maksymalnego trwania życia – wyzwania dla statystyki*. Wiadomości Statystyczne

- 11(618). GUS. Polskie Towarzystwo Statystyczne, Warszawa, 1–12.
- Żuradzki, T., 2010. Granice troski o przyszłe pokolenia. *Diametros* nr 26, 206–225.
- Żuradzki, T., 2015. Globalne ocieplenie i granice troski o przyszłe pokolenia (Global Warming and the Limits of Concern for Future Generations; December 6, 2015). Available at: <https://ssrn.com/abstract=2870383> or <http://dx.doi.org/10.2139/ssrn.2870383>.
- Żuradzki, T., 2020. Globalne ocieplenie i granice troski o przyszłe pokolenia, (in press), Available at: https://ruj.uj.edu.pl/xmlui/bitstream/handle/item/26574/zuradzki_globalne_ocieplenie_i_granice_troski.pdf?sequence=1&isAllowed=y.