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The Significance of Natural Environment in Reducing Long-Term Consequences of COVID-19. Tasks and Threats of Forest Pedagogy as Environmental Education

Znaczenie środowiska przyrodniczego dla łagodzenia długotrwałych następstw COVID-19. Zadania i zagrożenia pedagogiki leśnej jako edukacji ekologicznej

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Abstract: During COVID 19 pandemic- related restrictions it was observed that people were more willing to spend time in nature and the thus number of forest visitors doubled. It has been proven that communing with nature reduces symptoms of anxiety, depression, alleviates stress, improves concentration and vitality. It also strengthens the immunological response of the body and reduces the risk of cardiovascular diseases and obesity. Being in nature encourages people to show prosocial behaviour, strengthens social bonds, and even reduces the level of violence. There is a connection between lowering blood serum levels of cortisol, dopamine and norepinephrine and spending a significant amount of time in nature. Walking in the forest can be effective in mitigating the effects of the COVID-19 pandemic. The aim of the study was to summarize the long-term consequences of the COVID-19 pandemic, while indicating the therapeutic properties of the forest that can prevent or mitigate the effects of the disease caused by the SARS-CoV-2 virus. In addition, it was indicated what are the possibilities and tasks of forest pedagogy in encouraging people to take advantage of the benefits of forest recreation.

Keywords: environmental education, forest therapy, natural environment, forest bathing, individuals particularly vulnerable to the effects of the pandemic, outdoor learning

Streszczenie: W trakcie obostrzeń związanych z pandemią COVID-19 zaobserwowano, że ludzie chętniej spędzali czas na łonie natury, a liczba odwiedzających las wzrosła ponad dwukrotnie. Udowodniono, że obcowanie z przyrodą zmniejsza objawy lęku, depresji, redukuje stres, poprawia koncentrację i witalność, zwiększa odporność na infekcje i zmniejsza ryzyko związane z chorobami układu krążenia, nowotworami i otyłością. Przebywanie na łonie natury skłania człowieka do zachowań prospołecznych, sprzyja zacieśnianiu więzi społecznych, obniża poziom przemocy. Przebywanie w lesie obniża poziom kortyzolu, dopaminy i noradrenaliny. Spacerowanie w lesie może być skuteczne w łagodzeniu następstw pandemii COVID-19. Celem pracy było podsumowanie długotrwałych następstw pandemii COVID-19 przy jednoczesnym wskazaniu terapeutycznych właściwości lasu, które mogą działać profilaktycznie lub też łagodzić skutki przebytej choroby

wywołanej wirusem SARS-CoV-2. Ponadto wskazano, jakie są możliwości i zadania pedagogiki leśnej w zachęcaniu ludzi do korzystania z dobrodziejstw rekreacji leśnej.

Słowa kluczowe: edukacja ekologiczna, lasoterapia, środowisko przyrodnicze, kąpiele leśne, osoby szczególnie narażone na skutki pandemii, nauka na świeżym powietrzu

Introduction

The forest environment has long been enjoyed for its quiet atmosphere, beautiful scenery, calm climate, pleasant aromas, and clean fresh air (Li et al. 2016). The concept of spending time in a natural environment due to its regenerative and healing effects has been widely recognized since the 16th century (Marušáková et al. 2019). Currently, forest therapy is increasingly gaining on importance in prevention and treatment of many ailments. In 1982, a therapeutic technique, named as “Shinrin-yoku” (forest bathing) was developed in Japan. The technique improves a person’s physical and mental health in result of spending time in the forest and experiencing it through the senses (García and Miralles 2020, Wen et al. 2020). Forest bathing, which has similar effects to natural aromatherapy, is a short leisurely visit to a forest for the purpose of relaxation (Li et al. 2016). Forest bathing as a recognized relaxation and/or stress management activity and a method of preventing diseases and promoting health is becoming a focus of public attention (Li 2012, Li et al. 2016, Li 2018). Currently, it is also gaining popularity in Poland (Pietrzak-Zawadka and Zawadka 2015, Simonienko 2021).

During the COVID-19 pandemic, there was an increased interest in spending leisure time in nature. Weinbrenner et al. (2021) pointed out that forests were a popular social space, not only aiding stress management but also fostering relationships with others in a safe environment while maintaining recommended social distancing. Forests were one of the few uncrowded spaces accessible to everyone during the pandemic (Baranowska et al. 2021). The aim of this

study is to summarize the long-term consequences of the COVID-19 pandemic while highlighting the therapeutic properties of nature, with a particular emphasis on forests, which can be helpful in preventing or mitigating the effects of the pandemic. In addition, the study indicates the possibilities and tasks of forest pedagogy in encouraging people to take advantage of the benefits of forest recreation.

1. Groups particularly vulnerable to the effects of the COVID-19 pandemic

Since the beginning of the pandemic, it has been pointed out that the groups of people requiring special protection due to an increased risk of death from COVID-19 include individuals suffering from chronic illnesses as well as the geriatric population. Healthcare workers, people with disabilities and mental disorders, the homeless, and individuals residing in various care institutions are exposed to an increased risk of experiencing negative effects of SARS-CoV-2 infection (Douglas et al. 2020). Mandatory isolation and prolonged remote learning have also contributed to unfavourable changes in the functioning of children and adolescents (Cipora and Mielnik 2021). One of the consequences of restrictions on free movement, including the prohibition of leaving one’s place of residence during quarantine, was the exposure of isolated individuals to violence from household members (Usher et al. 2020). The scale of this phenomenon is difficult to estimate due to limited access to information from the victims. The social groups particularly vulnerable to experiencing serious consequences related to the pandemic are presented in Figure 1.

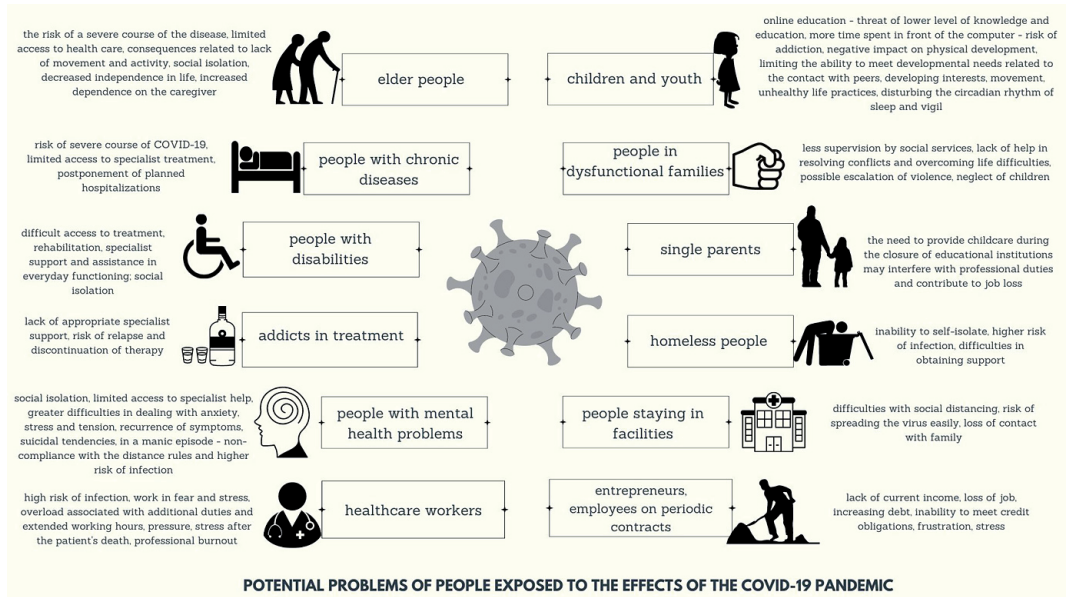


Figure 1. Individuals particularly vulnerable to the negative consequences of the pandemic. Own elaboration, based on (Douglas et al. 2020; Cipora and Mielnik 2022)

2. Effects of COVID-19 infection

Infection with the SARS-CoV-2 virus can structurally and functionally affect all human organs, and persistent symptoms can be observed in approximately 90% of individuals who have had COVID-19 (Becker 2020). Lopez-Leon et al. (Lopez-Leon et al. 2021) identified over 50 long-term consequences of COVID-19. It was estimated that around 80% of recovered individuals experienced at least one symptom persisting for a minimum of two weeks after recovery. The most common complaints included fatigue, headache, attention disorders, hair loss, and shortness of breath. Additionally, patients reported symptoms such as cough, hearing loss or tinnitus, insomnia, nausea and vomiting, chest pain, skin manifestations, and digestive disorders (Lopez-Leon et al. 2021). The most frequently reported respiratory system complaints were shortness of breath, increased fatigue and intolerance of physical exertion, and a sense of breathlessness (Filipiak 2021), as well as interstitial lung fibrosis (Higgins et al. 2021) with even functional lung changes observed in spirometry (Torres-Castro et al. 2021).

Becker (Becker 2020) highlights complications affecting the cardiovascular system. The author states that cardiac problems occur in approximately 80% of individuals who have recovered from COVID-19.

It has been shown that the SARS-CoV-2 virus can cross the blood-brain barrier or reach the brain through the olfactory bulb and induce neurological symptoms (Szczęśniak et al. 2021). The most common symptoms include dizziness and headaches, sensory disturbance including taste and smell disorders, sleep disturbances. Recovered individuals also report reduced cognitive abilities, difficulties with association and memory, attention deficits, and a sense of “COVID fog” (Filipiak 2021). The impact of SARS-CoV-2 on the central nervous system can also be caused by thromboembolic complications in the form of ischemic strokes (Zhang et al. 2021). Other consequences related to SARS-CoV-2 infection include autoimmune, rheumatic, dermatological, nephrological, and gastroenterological disorders. Patients report joint pain and numbness in the limbs, abdominal pain, diarrhea, and menstrual cycle disturbances

in women (Lopez-Leon et al. 2021). A new clinical entity has been identified in the paediatric population: paediatric multisystem inflammatory syndrome associated with COVID-19 (PIMS-TS), characterized by multiorgan damage (Davies et al. 2020) similar to well-known Kawasaki syndrome. Polypharmacy in a significant number of patients can lead to liver dysfunction. The restrictions on mobility have resulted in changes in physical activity habits and, in many cases, have led to weight gain, sarcopenia, and decreased physical fitness (Kirwan et al. 2020). All of these mentioned conditions significantly impact the quality of life of patients. The long-term consequences of COVID-19 and the isolation measures implemented to prevent the spread of the pandemic are presented in Figure 2.

Anxiety, high levels of stress, and depression are indicated as the most common psychological consequences of the pandemic. Olszewska-Guizzo et al. (2021) compared the physiological markers of depression and mood before and after COVID-19-related isolation. They confirmed an increase in depressive symptoms among the participants, as measured by questionnaires

and physiological markers. There was also a deterioration in the brain activity pattern associated with positive emotions. Individuals in isolation have been found to show a tendency to recognize more easily sadness and depression while experiencing a decrease in their ability to recognize joy (Meléndez et al. 2020). The necessity of staying in confinement has led to lifestyle changes. Remote work and learning, increased use of the Internet for entertainment purposes, have resulted in more time spent in front of screens. Stress and loneliness during the isolation period have been alleviated by alcohol and psychoactive substances (Iqbal et al. 2020). They have also contributed to changes in dietary habits, with a tendency to consume more sweets and unhealthy snacks (Kirwan et al. 2020).

All of these behaviours have increased the risk of behavioural and substance-related addictions (Iqbal et al. 2020). A social group that has particularly experienced the consequences of the pandemic are healthcare workers. A noteworthy aspect is the concept of “moral injury” that may occur within this group (Greenberg et al. 2020). Healthcare professionals have had to grapple with

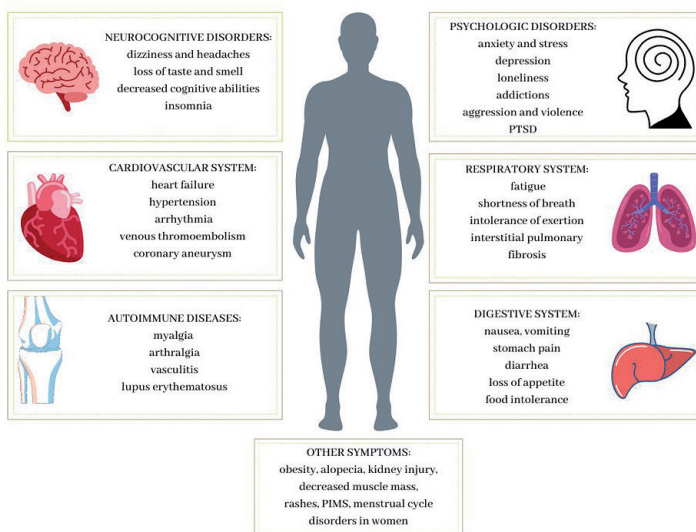


Figure 2. Long-term consequences of COVID-19 and isolation due to pandemic containment measures. Own elaboration, based on (Higgins et al. 2020; Filipiak 2021; Lopez-Leon et al. 2021; Szcześniak et al. 2021)

their own weaknesses, fears, and limitations on a daily basis, making decisions that can determine the life or death of a person, not always in line with their own beliefs and values. Such experiences give rise to feelings of helplessness, shame, guilt, disgust, and foster negative thoughts about oneself and others. This can contribute to mental health problems such as depression, post-traumatic stress disorder, or suicidal thoughts. It is not only isolation that has caused suffering and contributed to mental functioning issues. Individuals who have recovered from COVID-19 report chronic fatigue, cognitive impairments, disorientation, anxiety, low mood, insomnia, irritability, impulsivity, sleep disorders, or post-traumatic stress symptoms (Szcześniak et al. 2021). Księżka-Koszalka (2021) points out that the psychological effects of the pandemic may also have been positive. The pandemic can contribute to post-traumatic growth (Tomaszek and Muchacka-Cymerman 2020).

Many individuals, faced with threats, may have changed their perception of themselves, improved relationships with loved ones, reevaluated their lives, and began to value them more or made significant changes in their spiritual functioning. This tendency has been confirmed, among others, among nurses caring for COVID-19 patients. In addition to negative emotions such as sense of discomfort, helplessness, and fatigue, they also expressed increased sensitivity and gratitude, professional responsibility, self-reflection, and personal growth experiences (Sun et al. 2020). Restrictions on movement and the closure of publicly accessible recreational and sports facilities have led individuals who lead an active lifestyle and use swimming pools or gyms on a regular basis to seek alternatives. As a result, there has been an increased interest in forests as a space for relaxation, socializing, and engaging in physical activities (Baranowska et al. 2021).

3. The therapeutic significance of the forest

The importance of nature for human health and well-being is undeniable (Sundara Rajoo et al. 2021). A comprehensive analysis of the benefits that people derive from contact with nature has been presented by Kuo (2015). It points to consequences such as reducing symptoms of anxiety and depression, stress reduction, improved attention and vitality, improved immunity to infections, and reduced risk of cardiovascular diseases and cancers. Being in the forest reduces the levels of cortisol, dopamine, and noradrenaline (Wen et al. 2019). Contact with nature promotes the strengthening of social bonds and even reduces the level of violence. When being in nature, humans experience transcendence associated with contact with a force greater than themselves, which, in turn, encourages prosocial behaviour (Castelo et al. 2021). A positive attitude towards the forest is associated with a sense of life satisfaction (Koprowicz et al. 2022). Even a passive contact with the natural environment fosters positive emotions (Olszewska-Guizzo et al. 2021) and reduces stress (Meuwese et al. 2021). Walking in the forest promotes relaxation and alleviates negative symptoms of stress. It is recommended for providing individuals with a minimum level of physical activity (kinesiotherapy), oxygenating the body, improving blood circulation (Bielinis et al. 2020), improving fitness and motor coordination. Positive effects of forest bathing on cardiovascular, neuroendocrine, and metabolic functions have been demonstrated (Wen et al. 2019). The importance of physical activity for human health is undeniable, but not everyone can engage in intense physical exercises. Quiet walks in the forest can serve as an alternative. This form of therapy may contribute to the prevention of osteoporosis as it leads to increased bone density, resulting in a lower frequency of falls and fractures (Wang et al. 2020). If circumstances limit the ability to enjoy the benefits of the forest, watching videos recorded in a forest

environment is recommended to improve well-being. (Bielinis et al. 2020 Olszewska-Guizzo et al. 2021; Meuweese et al. 2021).

Even a virtual experience of the forest improves human functioning (Olszewska-Guizzo, Fogelc, Escoffierb, and Hod 2021), which indicates that this method of therapy can also be useful for people in quarantine or isolation. People in isolation were advised to watch a film about a forest for 5 minutes during 5 consecutive days. It turned out that even a short, virtual exposure to the natural environment was effective in reducing the level of perceived stress and anxiety of people forced to stay in a confined space in conditions of environmental deprivation. This effect was short-lived, but worth noting in the context of looking for ways to raise the mood of people who have been deprived of the natural environment for a long time (Zabini et al. 2020).

The forest is an ecosystem where plants play a significant role. Many of them possess medicinal properties (herbal medicine). In addition to plants, mushrooms can also have a beneficial impact on our health (Sadowska et al. 2020). Anti-cancer properties are characteristic of e.g. *Inonotus obliquus* (Ach. ex

Pers.) *Pilát* (Szychowski et al. 2020), used in production of medicines.

Essential oils released by plants in the forest environment (aromatherapy) contribute to improved well-being. They possess antibacterial, antifungal, and antiviral properties (Li 2010). Plant-derived phytoncides have antibacterial and antiviral properties (Jalinik 2021), which can facilitate respiratory tract regeneration (Roviello et al. 2022). The dominant species in Polish forests is the Scots pine. It is significant both in herbal medicine, as syrup made from its shoots alleviates symptoms of upper respiratory tract diseases, and in aromatherapy, as pine essential oils have calming effects and contribute to lowering blood pressure (Jalinik 2021). Beech forests also emit a large amount of volatile aromatic compounds, which promote improvement in psycho-physical condition (Spurio 2021).

Green is the dominant colour in the forest ecosystem, especially in spring and summer. The colour green in chromotherapy, as the colour of nature, is considered to promote regeneration of the nervous system. Additionally, it reduces heart rate during physical exertion (Briki and Majed 2019).

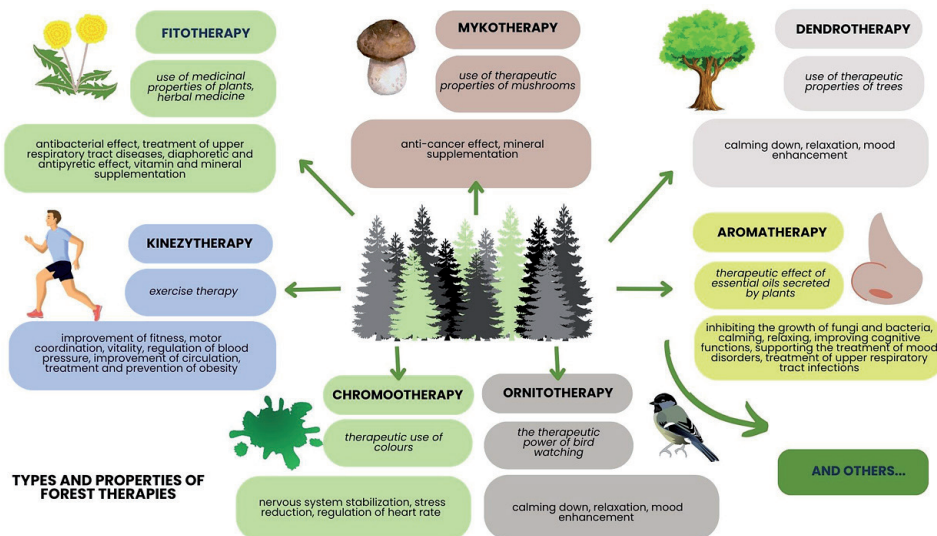


Figure 3. Types and properties of “forest therapies.” Own elaboration, based on (Jalinik 2021; Sadowska et al. 2020; Murawiec et al. 2021)

When spending time in the forest, humans can benefit not only from the therapeutic properties of plants but also from observing animals. Birdwatching, which is becoming increasingly popular, also has therapeutic effects. Ornithotherapy improves overall well-being by reducing stress and tension (Murawiec et al. 2021).

Therapeutic properties of the forest are summarized in Figure 3. A significant advantage of “forest therapies” is their widespread availability and low cost (Park et al. 2010), as well as the aforementioned positive impact on human health. Therefore, spending time in the forest may be an excellent suggestion for individuals dealing with the consequences of COVID-19.

4. The significance of the natural environment and Forest Therapy in alleviating the consequences of COVID-19

When examining the importance of green spaces in preventing the spread of epidemics and mitigating their consequences, three aspects should be considered:

1. **Global Aspect:** Robinson et al. (2022) associate the emergence of pandemics with ecosystem destruction. Referring to research demonstrating that the degradation of green areas is linked to outbreaks of dangerous infectious diseases, the authors emphasize that destruction of nature is a recipe for disaster. Deforestation for agriculture or urban development leads humans to encroach upon areas previously inhabited by wildlife, exposing us to pathogens that cross the species barrier. This mechanism is responsible for the emergence of new epidemics. Moreover, as pointed out by Afelt et al. (2018a), despite the fact that deforestation and land anthropization are often associated with species extinctions, some species in this new space find living environments consistent with their breeding and hunting needs. The authors point to bats as an example of such a species. These

mammals feel good near human settlements due to the abundance of food, unfortunately they are also carriers of various viruses. Human infection with animal-borne viruses can occur through direct contact, infection of domestic animals, or contamination with urine or faeces (Afelt et al. 2018b). The emergence of such a new pathogen in a previously unimmunized human population is associated with high mortality and the risk of epidemics. It is worth noting that the authors of the study described the mechanism of interspecies transmission of coronaviruses related to deforestation in 2018, i.e. before the world heard about SARS-CoV-2. Therefore, protection and restoration of nature are crucial for both recovery of humanity from COVID-19 and prevention of future pandemics.

2. **Social Aspect:** Nature has a significant impact on the health status of societies. Studies show, among other things, that forested areas have observed a lower percentage of severe cases and mortality due to COVID-19 (Roviello et al. 2022). Robinson et al. (2022) emphasize that ecosystem restoration can improve people’s living conditions and create “green jobs”. Activities such as tree planting, ecotherapy, and environmental management represent new areas of employment growth. Moreover, individuals who lost their jobs or whose companies became unprofitable during the pandemic could find employment in this field. It is also worth remembering that contact with nature is conducive to pro-social behaviour (Castelo et al. 2021). In this context, it is worth thinking about the presence of green areas near human habitations as a factor conducive to building social bonds, which may be particularly visible in small neighbouring communities.
3. **Individual Aspect:** Nature therapy contributes to reducing anxiety, stress, and symptoms of depression (Muro et al.

2023). During the recovery period after illness, spending time in the forest can not only strengthen the overall immune response but also improve oxygenation, lower cortisol levels, and enhance vitality, thereby improving sleep quality, coping with stress and frustration, and overall quality of life. Forest therapy also serves as a form of self-care aimed at maintaining mental health during and after the pandemic (Sundara Rajoo et al. 2021). Furthermore, it turns out that one does not even need to leave home to experience the benefits of forest therapy. Simulated forest immersion therapy (SFIT), utilizing not only virtual reality but also atomized phytoncides, among other factors, promotes improved immune response and alleviation of chronic pain, even in individuals with cancer (Ross and Jones 2022). Other studies indicate that virtual exposure to natural environments contributes to reduced stress and anxiety levels (Olszewska-Guizzo et al. 2021), greater emotional stability, and increased self-confidence (Park et al. 2010). This suggests that virtual forest therapy can be successfully applied to isolated individuals, individuals with disabilities preventing them from leaving their homes, or those living too far from forested areas.

5. Forest pedagogy and forest therapy - opportunities and threats

After three years of the pandemic, not only are there increasing numbers of reports from studies examining the impact of contact with nature on the health of individuals who have recovered from COVID-19, but there is also a growing number of popular science publications on this topic and centres that offer forest therapy and forest therapy workshops. However, it seems that we still do not sufficiently appreciate this natural therapeutic approach. On the contrary, we have limited our contact with the natural environment to such an extent that

psychology refers to it as “nature deficit disorder” pointing out the consequences of lack of contact with nature, such as chronic stress, decreased concentration, hyperactivity, lack of ability to name and control emotions, fatigue, poor motor coordination, and reduced physical fitness (Lindgren 2009). Why does this happen? In the awareness of Poles, there are still rooted beliefs regarding forests and forest recreation that, on the one hand, discourage this form of leisure and, on the other hand, contribute to the difficulties and threats encountered in the forest. Nationalization of the economy during the communist era in Poland led to the development of the belief that “state-owned” means “nobody’s.” Unfortunately, this mentality persists in some people to this day, which is why we often find abandoned garbage dumps in the forests. There are reports of toxic chemicals and illegal mineral extraction in the forest (Bednarz 2003). In the forest, one can come across old furniture, household appliances, machine parts, tires, construction material remnants, scrap metal, used batteries and accumulators, and even hazardous asbestos (Solan and Polonis 2012). During field exercises with forestry students at the Experimental Forest Station Siemianice, we observed goat carcasses wrapped in fertilizer bags – waste from illegal ritual slaughter. Every type of garbage has a negative impact on human well-being and the educational process, but the sight and unpleasant smell of carrion contribute to it in a particular way – such an experience can discourage the use of forest spaces for a long time.

Another serious problem is the fact that the forest is often chosen as a space for engaging in sexual activities. People known as “doggers” choose public spaces because engaging in sexual activities when other people can watch them is associated with strong arousal for them (Nomejko et al. 2010). Unfortunately, this phenomenon is becoming increasingly common and very harmful, especially for children. The presence of garbage left after such sexual encounters

in the forest (e.g., used condoms) evokes disgust and negates the beneficial impact of the forest on well-being. Discouragement from staying in the forest is also caused by hunting, which can take place from the end of October to the end of January, as well as various restrictions and prohibitions, such as those related to the risk of fire. Another factor, independent of human activity, that discourages forest excursions are biotic threats, such as insects. Ticks, in particular, have a repellent effect (Błasiak et al. 2017). Due to the diseases transmitted by these arachnids, people are more afraid of contact with ticks than encounters with animals such as wild boars or deer (Baranowska et al. 2021). Many of the threats described above have become deeply rooted in people's awareness in a distorted and exaggerated way. As Rykowski (2022) points out, "we need to learn from the forest again." It seems that this learning should start as early as possible because it is in a child's interaction with the environment, including the natural environment, that we should seek sources of values (Śliwerski 2022). Reliable education is a chance to encourage people to benefit from the blessings of the forest. Well-prepared educators can, for example, provide information on general principles of organizing hunts and the possibility of checking hunting areas in the Forest Data Bank, teach safety rules, behaviour in encounters with wild animals, or protection against ticks. Dealing with threats caused by humans, such as environmental pollution, is certainly more difficult, but it is another area addressed by environmental education.

The Forest Act of September 28, 1991, guarantees universal and free access to forests for citizens. The educational offer of the State Forests National Forest Holding (PGL LP) is very rich. In 2016, there were 7,000 educational facilities dedicated to nature and forest education. These included shelters, trails, educational points, parks and gardens, as well as reserves (Jóźwik 2019). Additionally, employees of the State Forests organize numerous educational events such as

field trips, lessons in forest chambers, competitions, festivals, fairs, and conduct lessons both in and outside of school. Over the 30 years of PGL LP's educational activities, more than 9,500 foresters have been involved, conducting over 31,000 different educational activities with the participation of nearly 1.9 million participants (Report on Educational Activities of the State Forests, CILP 2020).

In addition to the educational facilities available in PGL LP, forest pedagogy is supported by the attitude of people who want to visit forest areas. According to the "Stressed Poland" report from 2011, 88% of respondents said they wanted to spend time in the forest. To meet the needs of society, it is worth considering a broader use of the forest as a pedagogical space. According to Czyżewska (2007), forest education actually conducted in the forest is the best method of presenting the forest. In addition to "learning about the forest in the forest," we shape attitudes, appropriate behaviours, point out relationships, and directly experience nature. In the forest, we can feel the harmony of nature and realize how small humans are compared to the power of the forest. The forest is a place that teaches humility, distance from the world, and also develops imagination (Klimczak 2009).

In addition to the rich infrastructure, PGL LP has multimedia tools that can support those interested in using the forest as an educational space. These include "Las Rysia eRysia" and the "Virtual Laboratory of Interactive Teaching" portal. Furthermore, the Information Centre of the State Forests (CILP) provides a range of free publications on its website, including popular science materials, reports, forest calendars, and ready-made lesson plans. The mBDL application can facilitate orientation in the forest, providing information about the surrounding tree stands. All these elements are significant facilitations for individuals interested in forest pedagogy. Forest pedagogy should also align with the current trend of active

leisure. According to Dąbrowski and Zbucki (2014), these trends are evident among people of all ages who engage in activities such as walking, cycling, or horseback riding along forest trails throughout the year. Agrotourism, birdwatching, bushcraft, geocaching, forest therapy, forest bathing, and forest kindergartens are rapidly developing. Both foresters and teachers should take into account these emerging trends and societal needs and follow them in a pedagogical context.

A threat to the forest as a pedagogical medium is the shortage of forest educators. While PGL LP employs many forest educators, Rykowski (2022) points out that forest education conducted by PGL LP employees focuses more on forestry than the forest itself. Their main task is to shape the image of Polish forestry. This may be due to a lack of awareness among forest educator-foresters regarding contemporary pedagogical thinking and its existence in Poland. Contemporary pedagogical thinking encompasses deep competencies, which not only involve the ability to reflect on a chosen topic but also the capacity to reflect on oneself and acknowledge mistakes (Paluch 2021, Paluch and Tempczyk-Nagórka 2022). Therefore, to improve the culture of interacting with the forest, it is important to educate foresters in the pedagogical direction, teachers in the “forest” direction, and society in the culture of using the forest. It is also crucial to promote the forest as a pedagogical medium, create appropriate spaces, and promote them. Growing anthropopressure or climate change have resulted in increased interest in educating the public aimed at reducing the negative impact of man on the natural environment. Therefore, developed countries focus on biodiversity education, climate education, education for sustainable development, environmental education, and forest education. Educators are beginning to recognise the importance and benefits of introducing pupils to biodiversity and associated issues (Barker and Elliott 2000).

The Convention on Biological Diversity has positioned biodiversity as a key asset to be protected to ensure our well-being and that of future generations (Navarro-Perez and Tidball 2012). Environmental Education and Education for Sustainable Development acknowledge the relations and interdependencies between environmental and socio-economic issues (Navarro-Perez and Tidball 2012). The Environmental Education approach is focused on developing an environmentally literate citizenry through pedagogical models that provide problem solving and environmental management skills, which account for social realities and that intend to change the behaviour of individuals towards environmental issues (Sauvee 1999). To promote biodiversity education an issue to be taken more into account is service learning (Yli-Panula et al. 2018). Here, in our opinion, an important role should be played by foresters cooperating with teachers. According to Gruenewald (2003), service learning is a useful method for familiarizing students with the local environment. It connects living environments meaningfully to the lives of students and to the communities they come from (Yli-Panula et al. 2018).

Forests and forestry are an inseparable element of the life of local communities, and the forest as an ecosystem is one of the key elements of biodiversity. In 2021, the “Forest school with climate” program was launched in Polish schools, which was developed by the State Forests National Forest Holding in cooperation with the Ministry of Climate and Environment and the Ministry of Education and Science, which serves to inspire students and teachers to take actions that are conducive to the natural environment. As part of the program, foresters organize lectures and create an educational space (e.g. educational paths). Ready lesson plans are available on the website of the State Forests, in which topics related to sustainable forest management, biodiversity or ongoing climate change are discussed (LesnaszkoLasklimatem.pl 2023; Lasy.gov.pl 2023). According

to Strumińska-Doktór and Jagodzińska (2018), the State Forests conduct ecological education of the society, have well-educated staff and try to fill the gap in the education system regarding forests and forestry and contribute to the formation of pro-ecological attitudes of the youngest (Strumińska-Doktór and Jagodzińska 2018). In addition to the educational activities undertaken so far in the forests, we also propose the use of forest therapy or forest bathing. Forest therapy programs include various activities in forests such as experience of five senses, meditation in the forest, walking in the forest, ecological play, observation of animals and insects. Forest therapy programs have positive effects on sociality, depression, anxiety, self-esteem, stress, aggression, anger, and school adjustment (Song and Bang 2017). Using forest baths or forest therapy supports the fight against the negative effects of the pandemic, and also supports the forest education process.

Conclusion

Interacting with nature reduces symptoms of anxiety and depression, alleviates stress, improves concentration and vitality, enhances the functioning of the immune system, lowers cortisol, dopamine, and noradrenaline blood levels, and decreases the risk of cardiovascular diseases, cancer, and obesity. Being in nature serves encouraging pro-social behaviour, fosters social bonding, and can even reduce levels of violence. Utilizing the benefits of nature becomes a valuable, affordable, and accessible way for individuals to cope with long-lasting ailments caused by COVID-19, and caring for nature and restoring ecosystems can serve as a valuable weapon in combating new pathogens and preventing future pandemics. Hence, there is a need for continuous development and enrichment of reliable natural education.

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