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## RECREATIONAL POTENTIAL OF FORESTS AS AN INDICATOR OF LEISURE RELATED SERVICES PROVIDED BY FOREST ECOSYSTEMS

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### POTENCJAŁ REKREACYJNY LASÓW JAKO WSKAŹNIK ŚWIADCZENIA USŁUG WYPOCZYNKOWYCH EKOSYSTEMU LEŚNEGO

**STRESZCZENIE:** Celem pracy było określenie potencjału rekreacyjnego lasów położonych wokół uzdrowiska Rymanów Zdrój. Potencjał rekreacyjny lasów oceniono stosując metodę waloryzacji rekreacyjnej dla terenów o zróżnicowanej orografii. Lasy przydatne do rekreacji stanowią aż 86,31% z 2229,23 ha poddanych ocenie. Potencjał rekreacyjny badanych lasów wynosi ok. 82 500 osób na rok. Wskaźnik ten umożliwia właściwe sterowanie ruchem rekreacyjnym i równomierne jego rozłożenie na tereny naturalnie bardziej odporne na uszkodzenia.

**SŁOWA KLUCZOWE:** rekreacja leśna, świadczenia ekosystemów, czas wolny, użytkowanie lasu, uzdrowisko

## Introduction

Apart from being the source of lumber, forests play other functions: they can be used for leisure and recreation, they protect soils against erosion and waters against pollution, they greatly contribute to water retention system and to biological diversity, they purify the air and enrich landscapes. Out of all the functions which foresters refer to as non-productive (unrelated directly to timber production), in recent years the first one on the list has been rapidly growing<sup>1</sup>.

Increasing interest in forest-based leisure is particularly notable among residents of urban agglomerations<sup>2</sup>, and the larger the city the greater the interest in relaxation in forests developed for recreational purposes<sup>3</sup>. This trend is expected to continue in the near future<sup>4</sup>.

Location of a spa resort near forests brings measurable effects to patients' recuperation. It has been proven that contact with forests beneficially affects human mind and body<sup>5</sup>. This can be attributed e.g. to phytoncides produced by trees<sup>6</sup>. Falencka-Jabłońska believes that forests surrounding sanatoriums, because of their leisure related functions and healing climatic properties, contribute to the potential development of wellness tourism<sup>7</sup>. At the end of 2010 the total of 44 places in Poland had a status of spa resort, including four locations in the Podkarpackie Region: Rymanów Zdrój, Iwonicz Zdrój, Polańczyk and Horyniec Zdrój. All of these are surrounded by forests.

<sup>1</sup> *Raport o stanie lasów w Polsce 2013*, Warszawa 2014, p. 27–45.

<sup>2</sup> P. Paschalis-Jakubowicz, *Leśnictwo a leśna turystyka i rekreacja*, "Studia i Materiały Centrum Edukacji Przyrodniczo-Leśnej" 2009 no. 23, p. 30; S. Destan, S. Bekiroğlu, *Evaluation of the territorial system of forest recreation by natural indicators: Belgrade forest example*, "African Journal of Agricultural Research" 2011 no. 6(1), p. 222.

<sup>3</sup> T. Dudek, *Needs of the local population related to development of forests for recreational purposes: example of south-eastern Poland*, "Journal of Forest Science" 2016 no. 62, p. 37.

<sup>4</sup> S. Bell et al., *European Forest Recreation and Tourism: A Handbook*, London 2009, p. 262.

<sup>5</sup> B.J. Park et al., *Physiological effects of forest recreation in a young conifer forest in Hino-kage Town, Japan*, "Silva Fennica" 2009 no. 43(2), p. 291.

<sup>6</sup> A. Szponar, *Reconvalescent and recreational value of the forest environment*, in: J. Marak, Wyrzykowski, M. Szymczyk (eds), *Tourism Role in the Regional Economy, Health, wellness & spa tourism as the regional product – Theory and Practice*, Wrocław 2014, p. 119.

<sup>7</sup> M. Falencka-Jabłońska, *Walory przyrodnicze polskich lasów i ich uzdrowiskowo-turystyczne wykorzystanie*, "Inżynieria Ekologiczna" 2012 no. 30, p. 68.

It is estimated that the value of forest-based recreational services in various regions of the world is in the range from 2 to 279 US/ha<sup>8</sup>. It is expected that by 2050 recreational value of forests will increase, with the highest growth in China, North America and Europe<sup>9</sup>.

This author has been studying recreational potential of forests for a few years. Recreational potential is expressed as natural recreation carrying capacity of tree stands in person-hours/ha/day, defining the number of people who can stay at a given place at the same time without posing considerable hazard to the forest environment. In this form the indicator does not account for elements of forest development for recreational purposes, known to significantly reduce the risk of damage<sup>10</sup>.

The purpose of the study was to examine recreational potential of forests near the spa resort of Rymanów Zdrój and to apply the results to identify the possible leisure related services rendered by these forests.

## Research area

The study was carried out in the woods of Rymanów Forest District, surrounding the spa resort of Rymanów Zdrój. The area is located within the Low Beskids, at the altitude ranging from approx. 400 to over 600 metres above sea level. The areas with lower altitude comprise a broad valley of the River Tabor and its right-hand tributary the Czarny Potok, and those with higher altitude consist of gentle slopes covered with beech and fir forests. The major elevations here include Sucha Góra (611 m.a.s.l.), Mogiła (606 m), Zamczyska (568 m), Kopiec (634 m) and Dział (673 m).

The spa resort was established in Rymanów Zdrój in 1873. The profile of treatments provided here is linked with the specific climate and with the local resources. The local climate is affected by the nearby mountains and resembles continental climate. Mean annual air temperature is +7.3°C, with the mean in February -4.3°C and July +16.4°C (as measured at the station in Iwonicz Zdrój). Vegetation period ranges from 170 to 190 days. Average annual precipitation rate is high, ranging from 745 to 966 mm. Snow cover is

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<sup>8</sup> K.N. Ninan, M. Inoue, *Valuing forest ecosystem services: What we know and what we don't*, "Ecological Economics" 2013 no. 93, p. 145.

<sup>9</sup> A. Chiabai et al., *Economic Assessment of Forest Ecosystem Services Losses: Cost of Policy Inaction*, "Environmental and Resource Economics" 2011 no. 50, p. 429.

<sup>10</sup> A. Cieszewska, M. Deptuła, *Czynniki wpływające na degradację szlaków turystycznych na terenie Tatrzańskiego Parku Narodowego*, "Studia i Materiały Centrum Edukacji Przyrodniczo-Leśnej" 2013 no. 4(37), p. 81.

retained for 90–110 days during a year. Southern and northern winds prevail in the area<sup>11</sup>.

The spa resort was established in Rymanów Zdrój in 1873. The profile of treatments provided here is linked with the specific climate and with the local resources of carbonated mineral water. The spa resort is situated in one of the least polluted areas of Poland. The air is characterized by high contents of iodine, ozone, salts, and relatively high humidity. The carbonated saline and sodium containing water ranks among the most potent in Europe. Other healing minerals include iodide, bromide and boron saline waters, and therapeutic mud. Treatments are provided for lower and upper respiratory tract diseases, cardiovascular disorders, orthopedic and post-traumatic conditions, rheumatic, kidney and urinary tract disorders<sup>12</sup>.

Recreational potential was examined in 64 forest units, administered by Rymanów Forest District, comprising a total 2,229 ha. These forests are situated in the closest proximity to the spa resort and they directly contribute to the local microclimate; they are also eagerly visited by spa resort clients. A number of walking routes lead directly from Rymanów Zdrój to these forests. Along one of these, called “wellness path”, there are stations with exercise equipment and boards with explanations. This path leads through forest units: 88, 89, 101–103 selected for the study. Another interesting option for spa resort clients is the route designed for Nordic Walking. The five-kilometre long trail leads through areas with interesting natural features, from Wilcza Polana to Wołuszowa.

## Method

Recreational potential of the forests was assessed with recreational valuation method designed for areas with varied orography<sup>13</sup>. Assessment based on this approach takes into account three main criteria: habitat moisture, age of stands, and inclination of the terrain; and four additional criteria: stand density, presence of undergrowth and underbrush, soil cover and species composition of the stand. The potential, expressed by recreational capac-

<sup>11</sup> Plan Urządzenia lasu, plan dla lasów Nadleśnictwa Rymanów na okres 2009–2018, Krosno 2009, p. 34.

<sup>12</sup> T. Kozłowska-Szczęsna et al., *Bioklimat uzdrowisk polskich i możliwości jego wykorzystania w lecznictwie*, “Monografie Instytutu Geografii i Przestrzennego Zagospodarowania im. Stanisława Leszczyńskiego PAN” no. 3, Warszawa 2002, p. 408–417; [www.uzdrowisko-rymanow.com.pl](http://www.uzdrowisko-rymanow.com.pl) [27-06-2016].

<sup>13</sup> T. Dudek, *Assessment of recreational potential of forests in areas with diverse orography: Czarnorzecko-Strzyżowski Landscape Park case study*, “Sylvan” 2013 no. 157, p. 775–779.

ity indicator, is calculated as a product of multiplying the level of the tree stand recreational suitability by the surface of the stands of a given level. Then, average recreation carrying capacity of the forests was calculated as a quotient of the recreation carrying potential of the terrain and the overall surface of the stands in the relevant area. By multiplying the mean recreation carrying capacity by the number of days in a year and dividing the product by 24 hours the obtained result shows the acceptable number of visitors per one hectare during one year.

Unfortunately, management of Rymanów Spa Resort did not agree to provide information on the number and the structure of its clients. Hence, the author has referred to the data published by the Central Statistical Office in Kraków. Although majority of these data are related to provinces rather than individual facilities, they enable rough estimation of potential recreational traffic in the forests surrounding the spa resort. In 2010 the four spa resorts within the Podkarpackie Region were visited by the total of 57,479 patients staying for extended period of time, which accounted for 10.83% of all spa resort clients in Poland. This number was similar for 10 years,  $\pm 10\%$ . In the same year the number of spa resort clients in the commune of Rymanów amounted to approx. 14,000, including children accounting for 4% of the total number<sup>14</sup>. By reference to the previous findings related to the preferences of Podkarpackie region population related to forest-based leisure<sup>15</sup>, it can be assumed that 80% of spa resort clients will visit forests at least once a week. Average duration of a stay in a sanatorium is approx. 17 days<sup>16</sup>. After multiplying 80% of the number of spa resort clients by the number of forest visitors we will obtain an estimated annual number of visits to the relevant forests.

The characteristics of the study forests are based on the forest management plan drawn up for Rymanów Forest District<sup>17</sup>.

## Results

The examined stands, predominantly fir and beech forests, grow in the following habitats: mountain fresh forest (LGśw) – 80.19%, mountain mixed fresh forest (LMGśw) – 10.05% and highland fresh forest (Lwyżśw) – 9.76%.

<sup>14</sup> B. Bubula et al., *Lecznictwo uzdrowiskowe w Polsce w latach 2000–2010*, Kraków 2011, p. 49, 67, 90.

<sup>15</sup> T. Dudek, *Recreational potential of Rzeszów suburban forests versus the demand for spending leisure time in forests among the residents of the Podkarpackie Province*, "Sylvan" 2016 no. 160, p. 169–176.

<sup>16</sup> B. Bubula et al., op. cit., p. 69.

<sup>17</sup> Plan Urządzenia Lasu, op. cit.

Nearly half of them were more than 100 years old (42.02%) or approaching this age (7.03%). Large part of the forests near the spa resort were in the age range of 61–80 years (34.46%), and the remaining 16.49% are in the 3rd age class (41–60 years, the classes are counted every 20 years). All of the examined tree stands grow in sloping areas; majority of them in gentle and steep slopes (total of 49.46%) and in inclined areas (37.15%). The remaining 13.39% grow on precipitous slopes. Vast majority of the forests have moderate density, only 4.49% are found with high, and 3.62% with scarce density. The additional species found in the tree stands, most notably include: European larch (*Larix decidua* Mill.), Scots pine (*Pinus sylvestris* L.), common ash (*Fraxinus excelsior* L.) and sycamore maple (*Acer pseudoplatanus* L.).

Because of the exclusively fresh forest habitats, their favourable age structure and the lay of the land, the forests around the spa resort are highly useful for recreation. The forests suitable for recreation (table 1, level 2–4) account for 86.31% of the 2229.23 ha subjected to the assessment. On the other hand the forests poorly suitable or unsuitable for recreation (level 1 and 0), mainly due to their young age (80% in level 1 and 0), comprise only 13.69% of the area.

The calculated average recreation carrying capacity of the forests is 2.45 person-hour/ha/day, i.e. during a year 37 persons can stay in an area of 1 ha. Based on these calculations, the recreational potential of the examined forests amounts to approx. 82,500 people per year. The forests surrounding the spa resort of Rymanów Zdrój in a given year may be visited by approx. 28,000 spa resort clients. The estimated result suggests that the calculated recreational potential of these forests is utilized at the level of approx. 33%. Notably, these estimates do not take into account the local residents, tourists and people paying visits to spa resort clients.

**Table 1.** Recreation carrying capacity in the forests surrounding the spa resort of Rymanów Zdrój

Degree of recreational suitability	Area of forest stands [ha]	Percentage by area [%]	Recreational capacity [person-hours/day]
forests extremely suitable	260.66	11.69	1042
forests highly suitable	856.38	38.43	2569
forests moderately suitable	806.84	36.19	1613
forests poorly suitable	234.59	10.52	234
forests unsuitable for recreation	70.76	3.17	0
Total	2229.23	100.00	5458

## Discussion

Recreation is recognized among cultural ecosystem services, just like aesthetic assets as well as science and education<sup>18</sup>. Forest ecosystems render cultural services in all these areas. They provide space for leisure and recreation<sup>19</sup>, they enrich landscapes<sup>20</sup>, and they constitute a place for educating the public about nature<sup>21</sup>. Typically, cultural ecosystem services can be used many times in various ways<sup>22</sup>. A good example of this is the fact that forests provide a place for various forms of recreation, e.g. hiking, Nordic walking, cycling, horse-riding, etc.

The presented results show that a vast majority of the forests adjoining the spa resort of Rymanów Zdrój are suitable for recreational purposes (86%). This is far more than in the suburban forests of Rzeszów (56%), growing at a distance of up to 10 km from the administrative border of the city<sup>23</sup>, in the Bolimów Landscape Park (57%)<sup>24</sup>, in Magura National Park (60%)<sup>25</sup> and Czarnorzecko-Strzyżowski Landscape Reserve (73%)<sup>26</sup>. The same approach was applied in all the above studies, with some minor modifications in the studies carried out by Dudek. This large difference in the rate of forests suitable for recreation reported earlier partly results from the fact that the present study examined the smallest area of forests. The research area was limited to the forests adjoining the spa resort. For many years these

<sup>18</sup> J. Solon, *Koncepcja "Ecosystem Services" i jej zastosowanie w badaniach ekologiczno-krajobrazowych*, "Problemy Ekologii Krajobrazu" 2008 no 21, p. 29.

<sup>19</sup> B.J. Park et al., op. cit., p. 297; B. Ważyński, *Urządzanie i rekreacyjne zagospodarowanie lasu*, Warszawa 2011, p. 19.

<sup>20</sup> E.G. Petrova et al., *Comparing the visual perception and aesthetic evaluation of natural landscapes in Russia and Japan: cultural and environmental factors*, "Progress in Earth and Planetary Science" 2015 no. 2, p. 6; A. Senetra, *Las jako istotny komponent przestrzeni w aspekcie opracowywania map wartości krajobrazów wiejskich*, "Sylwan" 2015 no. 159(9), p. 764.

<sup>21</sup> E. Janeczko, *Ścieżki edukacyjne jako element rekreacyjnego zagospodarowania lasu*, "Studia i Materiały Centrum Edukacji Przyrodniczo-Leśnej" 2010 no. 1(24), p. 106; A. Grzywacz, *Podstawy programowe w szkołach podstawowych w zakresie wiedzy o lesie a treści kształcenia w edukacji leśnej realizowanej przez nadleśnictwa Lasów Państwowych*, "Studia i Materiały Centrum Edukacji Przyrodniczo-Leśnej" 2011 no. 1(26), p. 121; H. Kruk, *Działalność edukacyjna leśnych kompleksów promocyjnych w Polsce – wyniki badań*, "Studia i Prace Wydziału Nauk Ekonomicznych i Zarządzania" 2015 no. 42, p. 54.

<sup>22</sup> J. Solon, op. cit., p. 29.

<sup>23</sup> T. Dudek, *Recreational potential of Rzeszow...*, op. cit., p. 174.

<sup>24</sup> J. Kikulski, *The usefulness of selected forest areas of the Bolimowski Landscape Park for tourism and recreational needs*, "Sylwan" 2006 no. 150(6), p. 45.

<sup>25</sup> T. Dudek, *Recreational potential of the Magurski National Park versus the actual number of visitors*, "Sylwan" 2014 no. 158, p. 877.

<sup>26</sup> T. Dudek, *Assessment of recreational...*, op. cit., p. 777.

forests have been managed in sustainable manner, with emphasis on their protective functions (related to waters, microclimate and soils). As a result of these long-term efforts, there is a high proportion of over 100 year old stands of beech and fir forests (42%) in good condition.

Taking into account the supplementary criteria, the assessment was mostly impacted by the presence of undergrowth and underbrush and the soil cover. In 19% of the area, young trees grow in large numbers, covering  $\geq 40\%$  of the area, which resulted in decreased suitability of the forest stands for recreation. Similarly, Heyman<sup>27</sup> and Dudek<sup>28</sup> point out that dense underbrush is a factor adversely affecting recreational value of forests. Conversely, if it occurs in clusters occupying no more than 10% of the area it constitutes an added value, contributing to greater biological diversity and landscape attractiveness of the forests, in particular in single-story and single-species forests.

Monitoring applied to investigate the stress on forest ecosystems may be conducted with the use of discreet photocells located along the trails, designed to count the individuals walking by. Such solution would be less controversial than ongoing surveillance based on video cameras. This form of observation is proposed by Arnberger<sup>29</sup>. Using such approach it is possible to acquire more comprehensive information, not only about the number of visitors but also related to the preferred leisure activities (e.g. hiking, cycling, walking a dog, running, etc.), and the use of equipment installed for recreation related purposes.

This author believes, however, that the mental pressure linked with the presence of cameras, so common in cities, may negatively affect people's ability to relax in forests where they look for tranquillity and solitude. Research conducted worldwide has indeed confirmed that people mainly visit forests in order to relax<sup>30</sup>.

Monitoring is designed to keep up the number of forest visitors at a level which is assumed to be safe for the forest environment. Resulting from excessive stress to an ecosystem, the most vulnerable species may disappear from a given area which consequently leads to decreased biological diversity. Kos-tecka et al. emphasize that by paying attention to biological diversity of flora

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<sup>27</sup> E. Heyman, *Analysing recreational values and management effects in an urban forest with the visitor – employed photography method*, "Urban Forestry & Urban Greening" 2012 no. 11, p. 267.

<sup>28</sup> T. Dudek, *Recreational potential of Rzeszow...*, op. cit., p. 175.

<sup>29</sup> A. Arenberger, *Recreation use of urban forests: An inter-area comparison*, "Urban Forestry & Urban Greening" 2006 no. 4, p. 135-144.

<sup>30</sup> C.Y. Jim, W.Y. Chen, *Ecosystem services and valuation of urban forests in China*, "Cities" 2009 no. 26, p. 191; P. Gołos, *Rekreacyjna funkcja lasów miejskich i podmiejskich Warszawy*, "Leśne Prace Badawcze" 2013 no. 74(1), p. 62.



we also take care of the foundations of ecosystem services, and indeed, our own future<sup>31</sup>. Therefore, we can say that excessive exploitation of cultural services provided by forest ecosystems may lead to decreased availability or loss of certain services in this domain; so it is important to identify recreational potential and ensure compliance with it. Likewise, Plieninger et al. claim it is necessary to protect biological diversity and cultural heritage which are components of multifunctional ecosystem services. They also emphasize the fact that cultural ecosystem services are more appreciated by the public than regulating and supporting services, and frequently are more important than provisioning services<sup>32</sup>. A number of surveys have shown that leisure in forests is reported by a predominant (76–90%) part of the society<sup>33</sup>, hence forest based recreation constitutes a very important component of cultural services provided by forest ecosystems. This need was recognized in Sweden as early as the 1950s, when the so-called recreational forests were first designated; they were characterized by older age, large proportion of deciduous trees and alternative renewal methods<sup>34</sup>. The forests investigated in the present study, located in close proximity to Rymanów Zdrój spa resort, meet these three criteria attributed to recreational forests. Nearly half of these forests are more than 100 years old, they contain a large proportion of deciduous species and young generations of trees are initiated as a result of complex felling systems, in a natural way, with long period of renewal.

## Conclusion

The study has shown that the forests around the spa resort of Rymanów Zdrój have large recreational potential, which by spa clients is used at the level of approx. 33 %.

It must be ensured that these advantages resulting from the location of the spa resort amidst forest will not be impaired due to excessive or inadequately directed recreation traffic. To achieve this it is necessary to identify

<sup>31</sup> J. Kostecka et al., *Pojęcie "świadczona ekosystemowe" i jego rola w edukacji dla zrównoważonego rozwoju (na przykładzie bzu czarnego Sambucus nigra L.)*, "Inżynieria i Ochrona Środowiska" 2012 no. 4, p. 415.

<sup>32</sup> T. Plieninger et al., *Assessing, mapping, and quantifying cultural ecosystem services at community level*, "Land Use Policy" 2013 no. 33, p. 118, 127.

<sup>33</sup> T. Dudek, *Recreational potential of Rzeszów...*, op. cit., p. 172; P. Gołoś, op. cit., p. 60; J. Kikulski, *Preferencje rekreacyjne i potrzeby zagospodarowania rekreacyjnego lasów nadleśnictw Hawa i Dąbrowa (wyniki pierwszej części badań)*, "Sylwan" 2008 no. 5, p. 61.

<sup>34</sup> T. Paluch, *Rekreacyjna rola lasów w Szwecji*, "Studia i Materiały Centrum Edukacji Przyrodniczo-Leśnej" 2006 no. 3(13), p. 184, 185.

recreation carrying potential of the forests, to lead the recreational traffic to the forest areas with higher natural resistance to damage, and to provide designated parts of the forest with necessary infrastructure improving safety and conditions for relaxation. It is also necessary to monitor any changes occurring in the forest ecosystem as a result of its exploitation.

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