Agro-tourism Structures, SARS-CoV-2: the Role of Water

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Abstract. The agro-tourism environmental sustainability and its circular economy approaches represent the keys for the future development of the sector and in term of tourist presences, thanks to their growing attractivity. Water is one of the most used inputs in agro-tourism structures for internal (drinking, cooking, cleaning, etc.) and outdoor use (for agriculture and green areas management). In the scientific literature, the outdoor water use was more studied with regard the agro-tourism structures. The aim of the present paper is first to check and understand how the water consumption of an agro-tourism structure is managed and to propose solutions for its reduction, all in agreement with circular economy concepts, considering also the SARS-CoV-2 issue. Also, the role of tourists in helping, respect the rules and complying with the proposed solutions will be considered. The results demonstrate that a proper maintenance can be obtained by simply introducing simplified devices. Moreover, a key factor is the tourist information at agro-tourism structures. With a technological effort, water can be managed to favour reuse (e.g. grey water).

1 Introduction

In the last decades, the tourism sector has been continuing to grow worldwide, 2019 being the 10th consecutive year of lively growth [1] with a prediction of an increase of up to 1.8 billion tourist presences by 2030 [2]. However, the SARS-CoV-2 pandemic context has left marks in the tourism sector [3]. According to the United Nations World Tourism Organization (UNWTO), because of the impact of the SARS-CoV-2 pandemic, the international tourism expectations in the first quarter of 2021 are likely to decrease by about

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85%, compared to the same period of 2019 [4]. Nevertheless, following the scenarios depicted by the Organization for Economic Co-operation and Development (OECD) regarding the development of recovery strategies in the pandemic context, rural destinations are expected to be more attractive to tourists and revival the tourist arrivals due to the possible relative isolation linked with natural areas [5]. A recent study confirms the massive impact of COVID-19 on agro-tourism: during a pandemic, if movement and tourism are allowed, tourists tend to select destinations with lower density of people (e.g., rural areas) [6]. Another research confirms that, according to Polish respondents, holidays in the country, spent on agro-tourist farms, are the preferred choice in the era of the SARS-CoV-2 pandemic [7].

In rural regions, tourism has an important role by influencing the dynamics of the communities from the social, economic, and environmental points of view in the long-term. Rural tourism plays an important role in reducing the poverty and the phenomenon of emigration from rural villages [8] by valorising the natural and cultural heritage in a context of a sustainable development (SD) [9]. The role of rural tourism as a revitalizing cure for economically depressed rural areas has been acknowledged by several authors and by Programmes of the European Commission. According to Briedenhann and Wickens [10], rural tourism and the related activities have the capability of promoting the local economy of less developed regions. Cánoves et al. [11] argue that the recreational activities and attractions related to rural tourism have the potential for enriching the local landscape and culture, increasing the tourism demand on their turn. In the last decade, the European Commission has developed a set of Programmes to promote rural tourism and agro-tourism [12]. In general, tourists are attracted to rural regions by key elements like the landscape [13] and the specific social and cultural heritage [14] of a region.

Agro-tourism is a sector that has been continuously expanding in Romania in the last years [15-18]. The potential of Romanian rural tourism has already started to be exploited, thanks to the availability of a unique natural and cultural heritage in many Romanian rural areas [19]. In the last years, a continuously growing trend in the number of farmhouses transformed into agro-tourism structures (AS) can be observed in Romania (Figure 1) [20]. This growth is accompanied by an increasing tourist offer and tourist demand [21].

The concept of agro-tourism and rural tourism are different. Agro-tourism can be considered as a subgroup of rural tourism [22]. The latter takes place, in general, in the countryside and agro-tourism specifically takes place in farms [23]. The specific literature reveals numerous definitions of agro-tourism [24]. However, according to Yang et al. [25], agro-tourism and tourism are inevitably correlated. Agro-tourism needs visitors to sustain itself. The present paper will refer to those AS where tourists visit farms, participate in possible farm activities organized by AS structures to entertain their guests, buy products, enjoy the staying, eat a meal and make overnight stays.

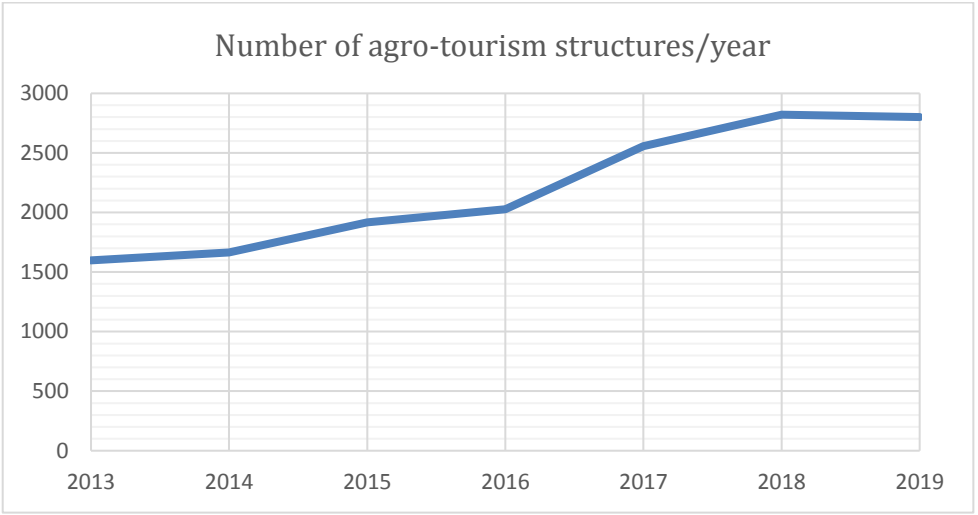

Fig. 1. The evolution of AS in Romania (2013-2019) [18].

Under a pandemic context, an increase in the agro-tourism sector requires the growth of the rural tourist demand and tourist offer, meaning an accelerated development in rural areas. The difficulty of estimating the SARS-CoV-2 pandemic influence on the agro-tourism sector is producing new challenges for a sustainable rural development perspective [26]. Under these circumstances, it is vital to bring more attention to the assessment of SD in terms of economic, social and environmental performance. In the case of agro-tourism, SD is intended as the capability of AS to supply resources in the long term.

The present paper will focus on the environmental impact of AS from a circular economy (CE) perspective because agro-tourism activities depend on the environment being the "subject matter" [27]. CE is based on a model of production and consumption involving resource recovery, recycling, and economic development model aiming to fulfil people's need, while reducing their impact on the environment, during the whole life cycle of the products [28]. The Circular Economy Action Plan focuses on the necessity of pursue a life-cycle-driven CE by recovering resources to the utmost and, consequently, reduce residual waste as more as possible [29]. Therefore, the CE approach in the agro-tourism sector requires practising a SD of agro-tourism activities through the promotion of a new concept concerning sustainable production and consumption principles. The present paper discusses the impacts of AS on the environment in terms of supply by capitalizing the resources and its connection with the environmental management performed under a CE perspective. The aim is to investigate and propose good practices concerning an important natural resource in AS: water. Due to the characteristics of agro-tourism activities as agriculture, livestock, traditional gastronomy, farm animal caring etc. [30], the growth of the local water consumption [31] and wastewater production [32] without compromising the environment is a challenge in the context of a SD. The good practices proposed in this article can also be considered by the rural community, taking into consideration the fact that the tourism water use is more likely as the local community water use [33]. As a matter of novelty, this paper especially focuses on water, whose use is investigated in detail, and on the changes in water use expected during the SARS-CoV-2 pandemic. Discussing how the pandemic has been influencing agro-tourism, especially in relation to water consumption, is the key target of this paper.

The increase in water consumption is influenced by the increase in the population, the consumption habits and the economic development. Water consumption is under increasing attention by organisations as OECD projecting that 40% of the worldwide population lives

in water-stressed river basins, and that the water demand will rise by 55% by 2050 [34]. According to the United Nations World Water Development Report, water scarcity is likely to affect about 6 billion people by 2050 [35]. In addition, water resources are affected by global warming, especially by human and physical processes and their interactions, by complex patterns in time and space, and by feedback responses [36].

In the tourism sector, the awareness of water consumption with the aim of reducing the intensity on water resources is discussed in Santamarta Cerezal et al. [37] and by many worldwide organizations: the UNWTO [38], the UN Environmental Programme (UNEP) [39] and the OECD [40]. The crucial element concerning SD in the tourism industry is the approach to water shortage [41]. However, additional research is needed on the tourism sector developed in rural areas, especially related to the efficient use of water. Not only gaps should be highlighted [42], but also best practices should be proposed.

In Romania, the concern of water consumption in tourism can be found in the scientific literature, which highlight the challenge of facing a sustainable tourism development in terms of water supply and sanitation, and wastewater infrastructure development [43].

2 Materials and methods

In relation to the research gaps in the tourism industry highlighted above, concerning the state of water consumption, this paper proposes good practices in AS, taking into consideration sustainable consumption patterns concerning the environmental conservation. The proposals are in relation to an increasing demand for water resources connected with the rural tourism activities of an AS, in a context of possible growing rural tourism demand in a pandemic time [5].

Water consumption in AS is much higher compared with household consumption, generally due to agriculture activities (irrigation), to the daily cleaning of rooms and laundry, to the preparation of food and dishwashing, etc. In addition, on holidays, tourists generally enjoy the shower or the bath for a longer time and usually consume more water than they would commonly do at home. Generally, the amount of drinking water consumed in AS is mainly due to the use of water for sanitary reasons. Nowadays, water consumption is accelerated by handwashing, the basic measures adopted since the beginning of the SARS-CoV-2 pandemic to prevent the spread virus.

Therefore, the possibility of continuing the growth of the agro-tourism sector without compromising the environment is a challenge. According to a study taking into consideration the water use related to tourism activities, a tourist consumes about 2,000-7,500 L/day [44]. Such contributions add up to the water needs for the irrigation of gardens and cultivated lands, which are by far the most water-consuming activities. In rural areas about 90% of agro-tourism structures receive drinking water by the connection to the municipal water supply system.

3 Results and discussion

The consumption regarding water is directly proportional with the size of the AS, which can be identified by the maximum number of guests during overnight stays and by the capacity of the restaurant. For a better monitoring of water consumption, it is recommended to check the consumption periodically in connection with the number of persons present in AS.

3.1 Accommodation and restrooms

A proper management of the water consumption of an AS can be achieved firstly by performing a regular maintenance of the plumbing, especially by checking pressure and possible leaks. As previously reported, tourists may be responsible for significant consumption of water. Water consumption could be easily reduced without affecting the service quality, for instance by installing water-saving devices at the taps. Such devices can be classified into three categories: 1) flow reducers, which essentially aim at diminishing the flow rate, 2) mixers, which mix water and air allowing for a quick adjustment of flow and temperature, and 3) friction-jet devices, which magnify the jet by a specifically designed air-water mixing. Considering that a significant part of water is used to produce hot water, the possible reduction of water consumption also allows for energy savings.

Water-saving devices turn particularly useful in a pandemic situation such as the spreading of COVID-19. According to the World Health Organization (WHO), in case of visible dirty hands, people should wash them with soap and water for 40-60 seconds [45], which is likely to be far higher than the normal duration of hand washing in a pre-pandemic situation. On the other hand, the same WHO guidelines indicate that, in case of non-visibly dirty hands, it is preferable to use alcohol-based hand sanitizers. This may partially reduce the water consumption, but may expose people and the environment to other pressures. Hand sanitizers are usually contained in polyethylene bottles, whose disposal increases the amount of waste generated by humans and exposes the environment to the potential risks deriving from the spread of microplastics, if a proper recycling route is not available or implemented. In addition, hand sanitizers may pose a health risk to users, basically related to the toxicity of specific components (e.g., alcohols and hydrogen peroxide), especially to children [46].

Finally, floor cleaning operations may entail a higher consumption of detergents during the pandemic, which can increase the indoor air concentration of volatile organic compounds and the related exposure of guests and staff.

3.2 Restaurant facilities and laundry services

Saving water in restaurant facilities and laundry services is possible by using low-energy appliances like dishwashers and washing machines. Low-energy appliances, besides reducing the energy consumption during a washing cycle, are able to reduce the consumption of water to perform the washing operations. Knowing how to properly operate such appliances (e.g., selecting the best settings for water temperature, washing cycle and spin-dryer speed) is crucial. However, to avoid the risk of a potential spreading of COVID-19, bed linen and towels should be washed frequently and, possibly, at temperatures > 60 °C [45]. AS should also select appliances belonging to the highest classes of energy efficiency when old appliances must be replaced.

3.3 Agro-tourism activities and behaviour management

The management of AS should focus the attention on the staff and tourists, and give them instructions for the implementation of good practices to save water during daily activities. Tourists have a strong influence on the policies and choices of agro-tourism and, thus, must not be considered as passive elements of AS. Therefore, it is important to involve the guests, stimulating conscious behaviours along with the efforts put into practice by the hosts. This new way of thinking should not be viewed as a degradation of the service quality, but as a possibility to promote and come up with a positive impact on environment. The successful involvement of tourists can be achieved by efficient communication strategies, which should highlight the importance of the targets that guests can help achieve.

Various practical technologies can allow for water savings in AS, but they can bring visible advantages only if guests and staff are able to implement virtuous behaviours. The latter may include, for instance, limiting the opening of taps only when needed, both for personal hygiene and during washing/cleaning activities.

3.4. Wastewater management

Water saving may be achieved also by efficient wastewater management. A well-designed plumbing system should be able to separate sewage from grey water. The latter is the water collected from washing machines, dishwashers, kitchen and toilet sinks, bathtubs and showers. Contrarily from sewage, grey water has a low content of nutrients and organic matter. There are several opportunities for the re-use of grey water locally. Under a non-pandemic situation, grey water could be used for irrigation and as flushing water in toilets after a mild treatment. However, the recent SARS-CoV-2 outbreak might question such practice, whose applicability should now be revised by the scientific community to ensure the safety of the users.

Where grey water is not collected separately from sewage, the higher amount of soaps and detergents used to prevent the diffusion of the SARS-CoV-2 may make wastewater management difficult. In wastewater treatment plants, surfactants and detergents are responsible for unwanted phenomena like foaming, reduced oxygen supply, denitrification and inhibition of the microbial activity [47]. The use of natural and eco-friendly detergents may represent a solution to this issue.

3.5 Garden and agriculture

Given the impossibility of re-using grey water, due to hygienic reasons, it is advisable that gardens and green areas use systems that allow for the re-use of rainwater. However, for crops, the use of rainwater only is not enough, due to the general wide extension of fields. In this case, drip irrigation systems should be used to minimize dispersions. Additional strategies include: 1) the implementation of greenhouse cultivation, which may save 24% water compared to surface irrigation according to a recent study [48], and 2) the use of micro-sprinkler irrigation systems [49]. The latter allows increasing the homogeneity of water distribution, thus avoiding water stagnation when excess water is supplied to crops or water deficit when the water does not reach crops.

4 Conclusions

Actions aiming at reducing the consumption of water (e.g., installing water-saving devices on taps, reusing rainwater and grey water, replacing old washing machines and dishwashers with new ones, implementing water-saving strategies in the irrigation of cultures), would increase the environmental sustainability of the agro-tourism sector and increase their attraction by tourists. Successful results could be achieved through efficient communication with the guests and providing clear instructions to the staff, in order to properly transfer responsible behaviours in water consumption and sustainable use of natural resources. Investing in water-saving strategies becomes even more important in the light of the recent SARS-CoV-2 outbreak, due to the higher water consumption expected for hand washing and the impossibility of re-using grey water.

From the point of view of the costs that an AS should consider, small investments (e.g., mixers, friction-jet devices, flow reducers, collection of meteoric water, changing the irrigation type of cultivated lands to drip systems) could allow for considerable savings in

water consumption. Higher investments, like the replacement of old washing machines and dishwaters with new and efficient ones, and renovations to the plumbing system, may lead to additional advantages in terms of water consumption and re-use, which could justify the costs for renovation in the long-term. However, the feasibility of re-using grey water during the pandemic requires further investigation to avoid risks for the users. The pandemic may affect also the quality of wastewater (sewage), where grey water is not collected separately, due to the higher use of soaps and detergents, which may cause a potential increase in the load of nutrients.

Thus, the agro-tourism and, in general, the tourist sectors require further research to investigate the impacts of the COVID-19 preventive measures in terms of water consumption, and wastewater production and quality. Defining the priority actions of AS (water consumption of agro-tourism rooms, gardens, support facilities, etc.), keeping track of their own performance and implementing suitable management strategies are anyway vital to improve the level of environmental sustainability of AS.

References

1. World Tourism Organization UNWTO, [Online]. Available: www.e-unwto.org/doi/pdf/10.18111/9789284422456 [Accessed 29.01.2021]
2. World Tourism Organization UNWTO, [Online]. Available: www.unwto.org/archive/global/press-release/2011-10-11/international-tourists-hit-18-billion-2030#:~:text=By%202030%2C%20arrivals%20are%20expected,friends%20and%20family%20every%20day [Accessed 29.01.2021]
3. S. Gössling, D. Scott, C.M. Hall, J. Sust. Tour. **29**, 1 (2020)
4. World Tourism Organization UNWTO, [Online]. Available: www.e-unwto.org/doi/abs/10.18111/wtobarometereng.2021.19.1.2 [Accessed 29.01.2021]
5. Organisation for Economic Co-operation and Development OECD, [Online]. Available: www.oecd.org/coronavirus/policy-responses/tourism-policy-responses-to-the-coronavirus-covid-19-6466aa20/#endnotea0z2 [Accessed 01.02.2021]
6. M. Roman, P. Grudzień, Agriculture **11**, 458 (2021)
7. M.M. Wojcieszak-Zbierska, A. Jęczmyk, J. Zawadka, J. Uglis, Agriculture **10**, 397 (2020)
8. I. Škrbić, V. Jegdić, S. Milošević, Economics of Agriculture **65**, 1 (2018)
9. M. Šastná, A. Vaishar, J. Brychta, K. Tuzová, J. Zloch, V. Stodolová, Sustainability **12,** 21 (2020)
10. J. Briedenhann, E. Wickens, Tour. Manag. **25**, 71 (2004)
11. G. Cánoves, M. Villarino, G.K. Priestley, A. Blanco, Geoforum **35**, 755 (2004)
12. European Commission, [Online]. Available: https://op.europa.eu/en/publication-detail/-/publication/e0707433-aa5f-11e6-aab7-01aa75ed71a1 [Accessed 08.09.2021]
13. M.J. Carneiro, J. Lima, A.L. Silva, J. Sust. Tour. **23**, 8-9 (2015)
14. J.L. Alfaro Navarro, M.E. Andrés Martínez, J.A. Mondéjar Jiménez, Curr. Issues Tour. **23**, (2020)
15. R. Giurea R., M. Ragazzi, M.V. Zebres, M.I. Achim, MATEC Web Conf. **121**, 10003 (2017)
16. R. Giurea, A.M. Ioan, M. Ragazzi, L.I. Cioca, Qual. Access Success **18**, 115 (2017)
17. L.I. Cioca, R. Giurea R., I. Precazzini M. Ragazzi M.I. Achim, M. Schiavon, E.C. Rada, AIP Conf. Proc. **1968**, 020022 (2018)
18. M. Ragazzi, I. Precazzini, E.C. Rada, M.I. Achim M.I., TE-RE-RD 2017, *Criteria for water management optimization in agrotourisms*, (Moieciu, Romania, 2017)
19. A. Ilieş, D.C. Ilieş, C. Tătar, M. Ilieş, *The Geography of Tourism in Romania* (Springer, Cham., 2017)
20. Institutul Național de Statistică, [Online]. Available: insse.ro/cms/ro/tags/turismul-romaniei [Accessed 30.01.2021]
21. B. Tenie, G. Fîntîneru, D. Smedescu, A. Fîntîneru, *Agriculture for Life, Life for Agriculture* (Bucharest, Romania, 2018)
22. I. Marian, Ovidius University Annals, Economic Sciences Series **17**, 2 (2017)

23. European Parliament, [Online]. Available: www.europarl.europa.eu/RegData/etudes/etudes/join/2013/495840/IPOLTRAN_ET(2013)495840_EN.pdf [Accessed 31.01.2021]
24. S. Phillip, C. Hunter, K. Blackstock, Tour. Manag**. 31,** 6 (2010)
25. Z. Yang, J. Cai, R. Sliuzas, Habitat Int. **34**, 374 (2010)
26. A. Polukhina, M. Sheresheva, M. Efremova, O. Suranova, O Agalakova, A. Antonov-Ovseenko, J. Risk Financial Manag. **14**, 1 (2021)
27. R. Ciolac, T. Iancu, I. Brad, G. Popescu, D. Marin, T. Adamov, Sustainability **12**, 15 (2020)
28. European Parliament, [Online]. Available: www.europarl.europa.eu/news/en/headlines/economy/20151201STO05603/circular-economy-definition-importance-and-benefits [Accessed 30.01.2021]
29. European Commission, A new Circular Economy Action Plan 2020 [Online]. Available: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0098 [Accessed 30.01.2021]
30. A. Rong-Da Liang, T.Y Hsiao, D.J. Chen, J.H. Lin, Tour. Rev. (2020)
31. A. M. Rico-Amoros, J. Olcina-Cantos, D. Sauri, Land Use Policy **26,** 2 (2009)
32. D. Antakyalı, J. Krampe, H. Steinmetz, Water Sci. Technol., **57,** 12 (2008)
33. S. Becken, Water Resour. Ind. **7-8** (2014)
34. Organisation for Economic Co-operation and Development OECD, [Online]. Available: www.oecd.org/env/indicators-modelling-outlooks/49846090.pdf [Accessed 5.01.2021]
35. A. Boretti, L. Rosa, NPJ Clean Water **2**, 1 (2019)
36. B. Bates, Z Kundzewicz, S. Wu, Technical Paper of the Intergovernmental Panel on Climate Change and Water (IPCC Secretariat, Geneva 2008)
37. J.C. Santamarta Cerezal, F.J. García Rodríguez, I. Ruiz Rosa, I. Int. J. Sust. Develop, **20**, 230 (2017)
38. World Tourism Organization UNWTO [Online]. Available: https://www.unwto.org/archive/asia/event/world-tourism-day-2013-tourism-and-water-protecting-our-common-future [Accessed 7.01.2021]
39. United Nations Environment Programme (UNEP), [Online]. Available: https://sustainabledevelopment.un.org/content/documents/126GER_synthesis_en.pdf [Accessed 7.01.2021]
40. Organisation for Economic Co-operation and Development, OECD Tourism trends and policies, [Online]. Available: https://www.thinktur.org/media/TENDENCIAS.pdf [Accessed 5.01.2021]
41. M. Hadjikakou, J. Chenoweth, G. Miller, G, *Water and Tourism in The Routledge handbook of tourism and the environment (1st ed.)* (Routledge, 2012)
42. L. Benge, A. Neef, *The Tourism–Disaster–Conflict Nexus* (Emerald Publishing Limited, 2018)
43. S.M. Frone, D.F. Frone, J. Tour. Hospital. Manag. **1,** 3 (2013)
44. S. Gössling, P. Peeters, C.M. Hall, J.P. Ceron, G. Dubois, L.V. Lehmann, D. Scott, Tour. Manag. **33**, 1 (2012)
45. World Health Organization WHO, [Online]. Available: www.who.int/publications/i/item/WHO-2019-nCoV-IPC-WASH-2020.4 [Accessed 15.06.2021]
46. A. Mahmood, M. Eqan, S. Pervez, H.A. Alghamdi, A.B. Tabinda, A. Yasar, K. Brindhadevi, A. Pugazhendhi, Sci. Tot. Environ. **742**, 140561 (2020)
47. A. Daverey, K. Dutta, J. Environ. Chem. Eng. **9**, 104754 (2021)
48. L.G. Raeisi, S. Morid, M. Delavar, R. Srinivasan, Agric. Water Manag. **223**, 105685 (2019)
49. L.-C. Zhai, L.-H. Lü, Z.-Q. Dong, L.-H. Zhang, X.-L. Jia, Z.-B. Zhang, J. Integr. Agric. **20**, 1687 (2021)