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The Effect of the Covid-19 Epidemic on Forestry Activities in the Bartın Province

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Research Article

Abstract – This study was discussed to reveal the negative effects of the coronavirus (Covid-19) epidemic on forestry activities with a multidimensional approach in the province of Bartın. To this aim, the data obtained from the questionnaire study, which was applied by face-to-face interview method in the full field with the employees of Bartın and Ulus forestry enterprise directorates and Bartın Nature Conservation and National Parks Branch Directorate, were used as material. Data were analyzed and evaluated via descriptive statistics, correlation analysis, Kruskal-Wallis H test. In the study, the coronavirus exposure levels of each forestry activity and the 12 forestry activity groups created were analyzed and different groups were determined according to the answers given by the forestry organization employees to the five-point Likert scale propositions. Correlations between the views on the levels of forestry activity being affected by the Covid-19 and some personal characteristics were determined. The null hypothesis (H_0), which states that the views on the effects of the coronavirus are not different according to some personal characteristics, was checked. At the end of the study, it was found that erosion control and rangeland improvement, silviculture, and wood production works with an impact score of ≤1.49 were not affected at all (0%) by the Covid-19 epidemic; the construction and maintenance of forest roads, afforestation and sapling production, forest and village relations activities, forest cadastre and non-wood forest product production with an impact score of 1.5-1.99 were negatively affected at a "very little" rate (13%); human resources management, forest protection, operating and marketing activities with an impact score of 2.0-2.49 were negatively affected at a "little" rate (25%), and nature conservation and national park activities with an impact score greater than ≥2.5 were negatively affected a "medium" level (50%). According to the findings, some suggestions were developed to reduce the effects of the Covid-19 epidemic, thus positive contributions were made to sustainable forestry and social welfare.

Keywords – *Coronavirus (Covid-19), forestry activities, forest management, sustainable forestry, Bartın*

Covid-19 Salgınının Bartın İli Ormancılık Faaliyetlerine Etkisi

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Araştırma Makalesi

Öz – Bu çalışma koronavirüs (Covid-19) salgınının ormancılık faaliyetleri üzerinde yarattığı olumsuz etkileri Bartın ili özelinde çok boyutlu bir yaklaşımla ortaya koymak amacıyla ele alınmıştır. Bu amaca ulaşmak için Bartın ve Ulus orman işletme müdürlükleri ile Bartın Doğa Koruma ve Milli Parklar Şube Müdürlüğünde çalışanlarla tam alanda yüz yüze görüşme usulüyle uygulanan anket çalışmasından elde edilen veriler materyal olarak kullanılmıştır. Veriler betimleyici istatistikler, korelasyon analizi, Kruskal-Wallis H testi yardımıyla analiz edilmiş ve değerlendirilmiştir. Çalışmada, ormancılık örgütü çalışanlarının 5'li Likert ölçekli önermelere verdikleri cevaplara göre her bir ormancılık faaliyetinin ve oluşturulan 12 ormancılık faaliyet grubunun koronavirüsten etkilenme düzeyleri analiz edilmiş ve farklı gruplar belirlenmiştir. Ormancılık faaliyetinin Covid-19'dan etkilenme düzeylerine ilişkin görüşlerle bazı kişisel özellikler arasındaki korelasyonlar saptanmıştır. Koronavirüsün etkileri konusundaki görüşlerin bazı kişisel özelliklere göre farklı olmadığı yönündeki sıfır hipotezinin (H_0) denetimi yapılmıştır. Çalışma sonucunda; etki puanı ≤1,49 olan erozyon kontrolü ve mera ıslahı, silvikültür ve odun üretimi çalışmalarının Covid-19 salgınından hiç etkilenmediği (%0); etki puanı 1,5-1,99 olan orman yolları yapımı ve bakımı, ağaçlandırma ve fidan üretimi, orman ve köy ilişkileri faaliyetleri, orman kadastrosu ve odun dışı orman ürünü üretiminin "çok az" oranda (%13) olumsuz etkilendiği; etki puanı 2,0-2,49 olan insan kaynakları yönetimi, orman koruma, işletme ve pazarlama faaliyetlerinin "az" oranda (%25) olumsuz etkilendiği ve etki puanı ≥2,5'den büyük olan doğa koruma ve milli park faaliyetlerinin "orta" derecede (%50) olumsuz etkilendiği anlaşılmıştır. Elde edilen bulgulara göre, Covid-19 salgınının etkilerini azaltılmak için bazı öneriler geliştirilmiş, böylece sürdürülebilir ormancılığa ve toplumsal refaha olumlu katkılar yapılmıştır.

Anahtar Kelimeler – *Koronavirüs (Covid-19), ormancılık faaliyetleri, orman işletmesi, sürdürülebilir ormancılık, Bartın*

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1. Introduction

Today, forestry is defined as a versatile and sustainable activity that covers all of the biological, technical, economic, managerial, social, and cultural activities carried out in order to provide goods and services from forest resources to the society continuously and optimally (Daşdemir, 2018). While producing wood and non-wood forest products needed by the society, social-cultural services and benefits such as regulating the climate and water regime, preventing erosion, contributing to public health, and protecting nature and recreation are provided from forest resources. In addition, forest resources are an important tool in creating employment, reducing rural poverty, and improving income distribution.

In addition to the measurable benefits of the forestry sector such as wood and non-wood products, it has many benefits such as soil and water protection, prevention of floods and avalanches, affecting the climate, oxygen production, and carbon dioxide consumption, reducing air pollution, reducing noise intensity, value as a gene source, positive features in terms of human health and recreation, etc. that their contribution to social life and national economy cannot be fully seen because of they cannot be measured (Gürses et al., 2000). Forests provide basic ecosystem services such as wood, food, fuel, fodder, non-wood products and shelter, as well as their contribution to soil and water conservation and clean air. It is home to about 80% of the species living in terrestrial ecosystems and contributes to the mitigation and adaptation of climate change and the preservation of biological diversity. It prevents soil destruction and desertification, and reduces natural disaster risks such as floods, landslides, avalanches, droughts, sand and dust storms (OGM, 2020). Forests are also of critical importance in the supply of clean water. Forested watersheds, including watersheds and wetlands, provide three-quarters of the water used for residential, agricultural, industrial, and ecological needs. Forests regulate underground and surface water flows and protect the quality and quantity of water (ÇOB, 2004).

In addition to the production of goods and services, the forestry sector in Turkey creates added value as well as produces other social benefits such as employing certain people, producing free or low-cost products, grazing, gathering, hunting, providing input to the forest industry, etc. While the share of the gross added value created by all sectors that make up the country's economy in the total production is 50%, the share of the added value created by the forestry sector in the total production of the sector is approximately 77%. The fact that it has such a high added value is due to its high forward connections (Türker, 1999; Daşdemir, 2018). In addition, the forestry sector has a great contribution to employment. Many economic activities such as grazing, gathering, hunting, camping, transportation, and forest products industries, which are dependent on forest resources, also create job opportunities and income effects (Daşdemir, 2018).

Therefore, sustainable management of forest resources has gained importance in order to meet the needs of both present and future generations for forestry products and ecosystem services and to achieve sustainable development goals. The process of sustainable development and sustainable forest management, which started with the Brundtland Report prepared by the World Environment and Development Commission for the first time in 1987, continued with the United Nations Environment and Development Conference held in Brazil in 1992. At this point, each country has developed sustainable forest management (SFM) criteria and indicators with ecological, economic and social content to measure how forest resources are managed (Adamowics, 2003). Some studies were also carried out in Turkey to determine SFM criteria and indicators (Porsuk, 2000; Görücü, 2002; Akyol, 2004; Ok, 2008; Durusoy, 2009; OGM, 2009, Hakverdi, 2020). The General Directorate of Forestry (OGM) has revealed the Turkey SFM criteria and indicator set, which consists of 6 criteria and 40 indicators, in line with the Forest Europe process, with its latest update in 2019 (OGM, 2020).

In addition to various factors (fire, insects, snow, storms, illegal cuttings, deforestation, etc.) that prevent the goods, services, and benefits offered from forests, global epidemic diseases that concern human health can adversely affect forest ecosystem services and forestry activities. Various epidemic diseases (cholera, tuberculosis, Spanish Flu, SARS, MERS, Avian Flu, Swine Flu, Ebola, etc.) have occurred from past to present, negatively affecting human health and activities in many sectors in the world and in Turkey. There

are also some studies examining the effects of such epidemics from the past to the present (Yiğit and Gümüşçü, 2016; Yılmaz, 2017; Tekin, 2018; Azap, 2020; Türk et al., 2020).

The Covid-19 epidemic, which emerged in the Wuhan province of China towards the end of 2019, also affected the world in a short time, causing loss of life in many countries and negativities in various sectors. In Turkey, it started to be seen in March 2020, and it adversely affected many sectors, especially in 2020, when the epidemic progressed rapidly and quarantine practices were applied intensively. With the measures taken since 2021, vaccine applications, and the emergence of new variants of the virus, its effect has gradually decreased, however the epidemic still continues. In this process, many studies have been conducted investigating the negative effects of the Covid-19 epidemic on aviation, agriculture, banking, tourism, sports, etc. sectors (Akça, 2020; Aydın and Güner, 2020; Aydın and Karabacak, 2020; Ersoy et al., 2020; Kayabaşı, 2020; Korkut et al., 2020; Koyuncu and Meçik, 2020; Tayar et al., 2020; Türkmen and Özsarı, 2020; Şahin and Peker, 2021).

Knowing the level of impact of the Covid-19 epidemic on forestry activities is important for sustainable forest management. It is also likely that many benefits will be interrupted and social welfare losses will occur in sectors linked to the forestry sector. In this context, some studies investigating the impact of the Covid-19 epidemic on the forestry sector, forest industry, forest management, ecotourism, protected areas, and forest recreation have been carried out (Basnyat et al., 2020; Derks et al., 2020; McGinlay et al., 2020; Ay, 2021; Ateş et al., 2021; Hakverdi and Akyol, 2021; Laudari et al., 2021). However, there is no comprehensive study investigating the effects on forestry activities in the Bartın province with a multidimensional approach and including all activities.

Therefore, in this study, the effects of the Covid-19 epidemic on forestry activities (wood production, non-wood forest product (NWFP) production, operating and marketing, silviculture, afforestation and sapling production, erosion control and rangeland improvement, forest roads construction, and maintenance, forest cadastre, forest and village relations (FVR), human resources management, forest protection and forest crimes, nature conservation and national park (NCNP) activities) in the province of Bartın were discussed with a multidimensional approach. Thus, the results of the study will provide original and important contributions to the scientific literature, practice, and sustainable forest management.

2. Material and Method

2.1. Study Area

The study was carried out in the province of Bartın. The Bartın province has four districts such as Central, Amasra, Kurucaşile and Ulus (Figure 1). 64% of the Bartın province, which has a total area of 2,143 km^2, is forest area (135,437 ha) (OGM, 2022). There are three units: the Bartın Forestry Enterprise Directorate (BFED) and the Ulus Forestry Enterprise Directorate (UFED) and the Bartın Nature Conservation and National Parks (BNCNP) Branch Directorate, which carry out forestry activities within the provincial borders.

The BFED, which is affiliated to the Zonguldak Regional Directorate of Forestry, has 11 Forest Management Chieftaincies including Amasra, Arıt, Bartın, Dumanlı, Günye, Gölderesi, Hasankadı, İnkum, Kozcagiz, Kurucaşile and Yenihan. The study area is 140,923 ha in total, of which 48% is normal forestland, 0.83% is degraded forest, 56% is forested, and 44% is deforested (BOİM, 2022). The UFED has 10 Forest Management Chieftaincies, namely Ardıç, Sökü, Kumluca, Sarıkaya, Abdipaşa, Ulusçayı, Drahna, Merer, Samatlar and Hasandede. The study area is 66,640.20 ha in total, of which 74% is forestland and 26% is deforested area. 86% (42,385.80 ha) of the forest area is normal grove, 12% (5,692.60 ha) is degraded grove, and 02% (1,378.80 ha) is treeless forest area (UOİM, 2022). The field of activity of the BNCNP Branch Directorate is limited to the province of Bartın, and it carries out its services under the 10th Regional (Sinop) Directorate of the General Directorate of Nature Conservation and National Parks.

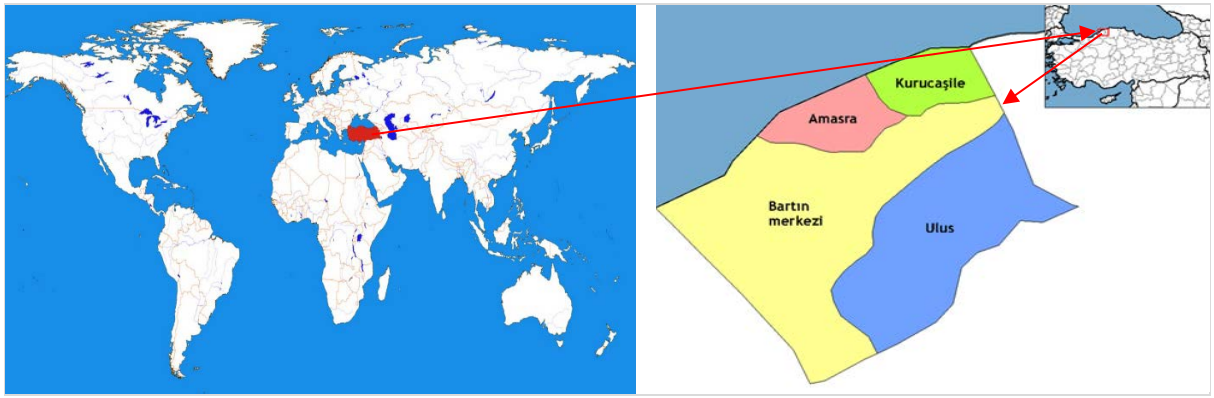

Figure 1. Study area

2.2. Research Data

The data of this study consists of the information obtained from the interview study conducted on the managers, technical staff, and field personnel (director, assistant director, forest chief, engineer, forest protection officer) in Bartın and Ulus forestry enterprise directorates and the BNCNP Branch Directorate.

In order to obtain the research data, a questionnaire form consisting of three parts was developed. *In the first part* of the questionnaire, there were seven questions about personal characteristics such as the unit where the participants worked, type of job, age, gender, education level, the total length of service (experience), and duration of duty (tenure). *In the second part* (the effects of the coronavirus epidemic on forestry activities), forestry activities were grouped under 12 main activities according to their similar characteristics, and a total of 64 propositions/questions were formed, with a different number in each group. The propositions were generally set up in accordance with the structure of "… activity was adversely affected" and the participants' level of agreement with these propositions was scored between 1-5 points with a five-point Likert scale (*1-I never agree, 2-I agree a little, 3-I agree, 4-I agree more, 5-I agree completely*) and it was measured with a five-point and equally spaced scale as in Figure 2 (Daşdemir, 2021). *In the third part* of the questionnaire, "opinions and suggestions of the participants on the effects of the coronavirus epidemic on forestry activities" were included in the form of an open-ended question.

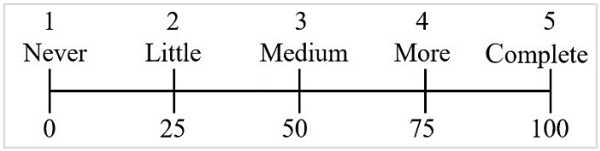

Figure 2. Five-point Likert ranking scale

There were a total of 111 employees (56 in BFED, 47 in UFED, 8 in BNCNP) as managers, technical staff, and field personnel (director, assistant director, forest chief, engineer, and forest protection officer) in Bartın and Ulus forestry enterprises and the BNCNP in 2021. It was planned to conduct an interview with all of them (in the full field), but 71 people could be reached due to various reasons. Thus, a survey study was conducted on a sample size of approximately 64% (=71/111*100) in May-November 2021 by face-to-face interview method.

2.3. Data Evaluation Method

In the study, two null hypotheses (H_0) were established: "The Covid-19 epidemic not effective on forestry activities" and "The opinions of the respondents on the effects of coronavirus do not differ according to some personal characteristics (unit, duty, age, gender, education level, experience, tenure)". These hypotheses were tried to be proven via the data obtained and the evaluation methods.

The questionnaire data were evaluated via descriptive statistics (frequency, percentage, arithmetic mean, standard deviation, etc.) and tables. The Cronbach Alpha test was applied to understand whether the five-point Likert scale propositions in the questionnaire were consistent and reliable with each other (Kalaycı, 2014; Büyüköztürk, 2015). The levels of impact of forestry activities from the coronavirus, their degree of impact, and impact rates were calculated, and evaluations were made according to the averages of the scores (average impact scores) of 71 participants on the propositions (questions) by forestry activity groups.

On the other hand, the relations between the "total impact score", which is formed by the sum of the scores given by the participants to 64 questions, and some personal characteristics (unit, duty, age, gender, education level, experience, tenure) were examined by correlation analysis. Since it was understood that the data did not show normal distribution by Kolmogorov-Smirnov test, Spearman's nonparametric correlation analysis was applied. In addition, the control of the H_0 hypothesis, whether the opinions of forestry organization employees in the Bartın province are different according to some personal characteristics, was checked with the Kruskal-Wallis H test, and Post Hoc multiple comparison tests were applied to reveal different groups (Kalıpsız, 1988; Özdamar, 2002; Daşdemir, 2021). Microsoft Excel and SPSS 22.0 (Statistical Package for Social Sciences) package program were used for the analysis and evaluation of the data.

3. Results and Discussion

3.1. Evaluations of Participants' Personal Characteristics

As a result of a total of 71 surveys conducted at the BFED, UFED, and BNCNP, the findings regarding some personal characteristics (unit, duty, age, gender, education level, experience, tenure) of the participants are given in Table 1.

Table 1
Some personal characteristics of the participants

Feature	Groups	Number	Percentage	Average ($\overline{x}$)
Unit	BFED	42	59.2	-
	UFED	27	38.0	
	BNCNP	2	2.8	
Duty	Director and Assistant Director	5	7.0	-
	Forest Chief	20	28.2	
	Engineer	3	4.2	
	Forest Protection Officer	43	60.6	
Age (year)	20-30	41	57.7	33.8 year
	31-40	11	15.5	
	41-50	12	16.9	
	≥51	7	9.9	
Gender	Male	59	83.1	-
	Female	12	16.9	
Education Level	1. High School	6	8.5	2.55 (Associate degree-Bachelor Degree)
	2. Associate Degree	29	40.8	
	3. Bachelor Degree	27	38.0	
	4. Graduate School	9	12.7	
Experience (year)	0-10	52	73.2	8.3 year
	11-20	8	11.3	
	21-30	8	11.3	
	≥31	3	4.2	
Tenure (year)	0-5	67	94.4	2.5 year
	≥6	4	5.6	

According to Table 1, the majority of the participants are the BFED personnel and forest protection officers working in the field. The average age is 33.8 years, with relatively young participants. Approximately 91.5%

of them are university graduates. The average total service period is 8.3 years and the time spent in the current position is 2.5 years. In other words, there is an employee structure mostly male, university graduates, young and inexperienced. It is thought that the study area is a relatively deprived area and rotation practices are effective in this.

3.2. Explanations and Evaluations Regarding Forestry Activity Groups

The α value of the Cronbach Alpha test results for each of the 64 propositions (questions) having a five-point Likert scale in the questionnaire form was found as ≥0.928 and the α value of the test result of the scale averages was found as 0.931. In this case, since the Cronbach Alpha value (α) was higher than 0.80 in both cases, it was understood that the questionnaire was "highly reliable" (Kalaycı, 2014; Büyüköztürk, 2015). Thus, it was determined that the propositions in the scale were reliable and consistent for statistical analyzes and evaluations.

In the study, forestry activities were gathered under 12 main groups and totally 64 questions having a five-point Likert scale were developed, with different numbers in each group. The explanations regarding the forestry activities in each group, the number of questions (Q), the minimum and maximum values of the points given by the participants to them, the Likert scale average score, standard deviation (s), and percentage shares (%) are given in Table 2.

Table 2
Features of forestry activity groups

No	Activity Group Name	Explanation	Number of Questions	Min.	Max.	Likert Average Score	s	%
1	Wood Production	The amount of stamps, total wood production and fuel production, transportation to the warehouse, production quality, and amount of standing tree sale	7 pieces (Q1-Q7)	1.00	3.00	1.48	0.55	6.84
2	NWFP Production	Laurel, chestnut, rosehip, cranberry, linden, etc., and mushroom production	4 pieces (Q8-Q11)	1.00	4.25	1.80	0.83	8.29
3	Operating and Marketing	Production costs, approximate prices, sales prices, number of customers participating in auctions, and sales prices of planted trees	7 pieces (Q12-Q18)	1.00	4.00	2.23	0.75	10.28
4	Silviculture	Youth, frequency, first thinning care, rejuvenation studies, and maintenance allowable cut	5 pieces (Q19-Q23)	1.00	4.60	1.46	0.80	6.73
5	Afforestation and Sapling Production	Land preparation, sapling planting, culture care, sapling production	5 pieces (Q24-Q28)	1.00	4.00	1.63	0.76	7.53
6	Erosion Control and Rangeland Improvement	The amount of erosion control and rangeland improvement work	2 pieces (Q29-Q30)	1.00	4.00	1.46	0.71	6.72
7	Forest Roads	New forest road construction, maintenance and repair of existing roads	2 pieces (Q31-Q32)	1.00	4.50	1.53	0.92	7.04
8	Forest Cadastre	Forest area with completed cadastre, 2/B applications and working sensitivity	3 pieces (Q33-Q35)	1.00	4.33	1.71	0.85	7.90

Table 2
Features of forestry activity groups (continues)

No	Activity Group Name	Explanation	Number of Questions	Min.	Max.	Likert Average Score	s	%
9	FVR Activities	Loans given to forest villagers, training and consultancy services, employment and income amount, contribution to rural development	6 pieces (Q36-Q41)	1.00	4.33	1.65	0.85	7.63
10	Human Resources Management	Providing labor, attendance, the productivity of the workforce, employee interest in the job, task, and relocation	7 pieces (Q42-Q48)	1.00	4.29	2.07	0.80	9.53
11	Forest Protection and Forest Crimes	Protection of forests, efforts to combat forest fires and forest pests, forest crimes (cutting, possession, transport, occupation and exploitation, grazing, burning, hunting, etc.)	11 pieces (Q49-Q59)	1.00	4.45	2.13	0.94	9.80
12	NCNP Activities	Hunting tourism, ecotourism, recreation activities, wildlife studies	5 pieces (Q60- Q64)	1.00	5.00	2.54	1.10	11.70
Total			64	12	54.31	21.69	9.85	100
Average Impact Score				0.98	3.56	1.85	0.57	-
Total Impact Score				64	232	120.27	37.12	-

In Table 2, the lowest total impact score was calculated as 64, the highest as 232, and the mean total impact score was calculated as 120.27±37.12 ($\bar{x}$±s) according to the scores given by 71 interviewees to each of the questions. The average impact score is 1.85±57 according to the general average of all questions.

On the other hand, in order to evaluate the exposure levels of forestry activities to coronavirus, the class interval values and effect levels of the five-point Likert scale were determined as in Table 3. Since the scores given to the survey questions are generally concentrated in the range of 1.5-2.49, this class range was divided into two ranges, 1.5-1.99 and 2-2.49, to increase precision.

Table 3
Class interval values and effect levels related to the five-point Likert scale

Class Range Values of the Likert Scale		Impact Level
Number	**Percentage (%)**	
≤1.49	0	Never
1.5-1.99	13	Very Little
2.0-2.49	25	Little
2.5-3.49	50	Medium
3.5-4.49	75	More
≥4.5	100	Complete

By using Tables 2 and 3, the averages of the five-point Likert scale scores were evaluated by forestry activity groups. In this context, the participants answered "I never agree" according to the average score (1.48) of the first seven questions (Q1-Q7) on wood production. With this result, the opinion was that wood production activities (stamping, cutting, transporting, standing tree sale) were not affected by the Covid-19 epidemic. Since the answer to the questions about NWFP production (Q8-Q11) was "I agree very little" according to the average score (1.80), it was concluded that the production of NWFPs was slightly by the Covid-19 epidemic. In operating and marketing activities (Q12-Q18), the answer was "I agree little" with an average score of (2.23). In other words, it has emerged that the operating and marketing activities (production costs,

approximate prices, timber sales prices, and the number of bidders) were negatively affected by the Covid-19 epidemic.

It turned out that silviculture activities (Q19-Q23) were not affected by Covid-19 epidemic according to their average score (1.46). Likewise, since the average of the answers given to the questions of erosion control and rangeland improvement (Q29-Q30) and wood production (Q1-Q7) activities was "I never agree", it was understood that such forestry activities carried out in open-air conditions were not affected by the Covid-19 epidemic. On the other hand, since the averages of the questions' scores of the construction and maintenance of forest roads (Q31-Q32), forest cadastre (Q33-Q35), afforestation and sapling production (Q24-Q28), and FVR (Q36-Q41) activities were close to each other and it was between 1.5-2, it is concluded that they were "very little" affected by the Covid-19 epidemic.

When evaluated in terms of human resources management activity, the average score of the related questions (Q42-Q48) in the questionnaire was 2.07 (I agree little). According to this result, it was understood that there were disruptions in the continuation of the staff in the administrative-office works, the productivity of the workforce was decreased, and therefore the human resources management activities were slightly affected by the Covid-19 epidemic. The average score of forest protection and forest crimes (Q49-Q59) activities is 2.13 (I agree little). However, when such activities are examined in two sub-groups as "forest protection" and "forest crimes", it was understood that the score of forest protection activities was generally lower than the score of forest crimes. Therefore, it was concluded that forest crimes were partially negatively affected by the Covid-19 epidemic (because there was an increase in the number of crimes) rather than forest protection activities. On the other hand, according to the average of the scores related to NCNP activities (Q60-Q64), which have the highest average score (2.54), it was revealed that there was a significant decrease in the recreational (picnic, recreation-resting, nature walk, etc.) demands of the people, especially during the pandemic period.

3.3. Effects of Covid-19 and Difference Control by Forestry Activity Groups

The average scores (average impact scores) given by the participants to the five-point Likert scale questions based on 12 forestry activity groups, their impact degrees, and impact rates were calculated by using the class range values in Table 3, and they are given in Table 4.

Table 4
Impact levels of forestry activity groups from the Covid-19

Activity Name	Likert Scale		
	Average Impact Score	Impact Degree	Impact Rate (%)
Erosion Control and Rangeland Improvement	1,46	Never	0
Silviculture	1,46	Never	0
Wood Production	1,48	Never	0
Forest Roads	1,53	Very Little	13
Afforestation and Sapling Production	1,63	Very Little	13
FVR Activities	1,65	Very Little	13
Forest Cadastre	1,71	Very Little	13
NWFP Production	1,80	Very Little	13
Human Resources Management	2,07	Little	25
Forest Protection and Forest Crimes	2,13	Little	25
Operating and Marketing	2,23	Little	25
NCNP Activities	2,54	Medium	50
Average	1,85	Very Little	25

As seen from Table 4, it can be said that forestry activities, in general, were negatively affected by the coronavirus epidemic at a rate of "very little", approximately 13%, according to the average of the Likert scores (1.85). However, erosion control and rangeland improvement, silviculture and wood production activities with an average impact score of ≤1.49 were not affected at all by the coronavirus epidemic (0%). The construction and maintenance of forest roads, afforestation and sapling production, FVR activities, forest cadastre and NWFP production having an average impact score of 1.5-1.99 were adversely affected at a "very little" rate

(13%). Human resources management, forest protection, operating and marketing activities, which have an average impact score of 2.0-2.49, were negatively affected by the coronavirus epidemic at a "little" (25%) rate, and NCNP activities with an average impact score of ≥2.5 are negatively affected at a "medium" level (50%).

On the other hand, as a result of the Kruskal-Wallis H Test applied to control whether there is a difference on the basis of forestry activities according to the average impact scores, it was understood that there was a significant difference at the 99% confidence level in terms of the average impact score of forestry activities (χ^2 =145.26; p=0.00>0.01). The activity groups formed at the end of the Post Hoc multiple comparison test (Games-Howell) was conducted to understand which forestry activities are different from each other (Table 5).

Table 5
Results on the difference test of the effects of Covid-19 on the basis of forestry activities

Activities Group (*)	**Activities in Group (*)**	**Average Impact Score of the Group**	**Impact Level of the Group**
1.Group	Erosion Control and Rangeland Improvement Silviculture Wood Production	1,47	Never
2.Group	Forest Roads Afforestation and Sapling Production FVR Activities Forest Cadastre NWFP Production	1,72	Very Little
3.Group	Human Resources Management Forest Protection and Forest Crimes Operating and Marketing	2,12	Little
4.Group	NCNP Activities	2,54	Medium

(*) Activity groups and activities within groups were ranked from least affected to most affected

According to these results, erosion control and rangeland improvement, silviculture, and wood production activities in the 1st group were not "never" affected by the Covid-19 epidemic. The fact that such technical activities are carried out in open-air conditions, in natural and non-crowded environments was effective in this. Forest roads, afforestation and sapling production, FVR, forest cadastre, and NWFP production activities in the 2nd group were "very little" affected by the coronavirus epidemic. Human resource management, forest protection, operating and marketing activities in the 3rd group were "little" affected by the Covid-19 epidemic. In this context, it can be said that the staff does not go to the workplace and work much, customers who buy wood materials do not participate in auctions, and there are problems in the protection of forests and forest crimes increase during the Covid-19 epidemic period. On the other hand, NCNP activities in the 4th group are mostly aimed to meet the hunting tourism, ecotourism, and recreational needs of the people, and it was understood that NCNP activities were negatively affected "medium" level since such demands were not received during the Covid-19 epidemic period.

There are different research results in the literature on the effects of Covid-19. In a survey study on 48 forest management chiefs in the Kayseri Regional Directorate of Forestry in Turkey (Hakverdi and Akyol, 2021); it was revealed that forest management chiefs were not affected by the Covid-19 pandemic, they continue their work and there was no disruption in their work. In a semi-structured interview-based study of forestry activities in Nepal's Gandaki province (Laudari et al., 2021); it was stated that wood production decreased during the coronavirus epidemic periods, while there was an increase in ecotourism, forest development, wildlife studies and illegal logging. Likewise, in a survey study in Nepal (Basnyat et al., 2020); it was detected that Covid-19

was causing less damage to wildlife and therefore more chance for wildlife to be observed, carbon emissions and air pollution rates were decreased, timber production and sales were greatly reduced, and poaching and illegal tree cutting were increased during quarantine. In a study in the Kottenforst nature reserve area in Germany (Derks et al., 2020), it was determined that Covid-19 increased forest recreation activities and there was a large increase in the number of visitors to the area. Similarly, McGinlay et al. (2020) on 14 popular protected areas in Europe; Although there was a decrease in the number of visitors during the strict quarantine periods, it is stated that there was a very high increase after the quarantine and therefore caused some problems. Similarly, McGinlay et al. (2020) stated that although there was a decrease in the number of visitors at the beginning during the strict quarantine periods, there was a very high increase after the quarantine and therefore it caused some problems in their research on 14 popular protected areas in Europe. On the other hand, Brancalion et al. (2020) found that tropical deforestation increased nearly twice during the Covid-19 pandemic period compared to 2019, and in general, deforestation increased by 63% in the Americas and Asia-Pacific, and by 136% in Africa.

All these results show that the effects of the Covid-19 epidemic give different results according to time, place, and the nature of forestry activity. For example, although it was determined that there was no disruption in wood production, especially during the Covid-19 epidemic period in this study, it was found that wood production decreased in the studies in Nepal (Laudari et al., 2021; Basnyat et al., 2020). Likewise, although there was a decrease in forest recreation activities in this study, it was stated that there was an increase in forest recreation activities and the number of visitors to the area in a study in Germany (Derks et al., 2020). On the other hand, it is a common result that both in this study and in other studies (Laudari et al., 2021; Basnyat et al., 2020), it was determined that there was an increase in forest crimes (illegal tree cutting, poaching, etc.) during the Covid-19 epidemic period.

3.4. Effects of Covid-19 and Difference Control by Personal Characteristics

In the study, the relationship between the "total impact score" variable, which was found by totaling the scores given to 64 questions by the participants and personal characteristics/variables (unit, duty, age, gender, education level, experience, and tenure) were examined by Spearman's nonparametric correlation analysis and the results are shown in Table 6.

Table 6
Correlation analysis results

Variables	Total Impact Score
Unit	0.238*
Duty	0.07
Age	0.05
Gender	-0.07
Education Level	0.05
Experience	-0.11
Tenure	-0.13

*: Significant at 0.05 confidence level ($p<0.05$)

According to the results of the correlation analysis, there is a statistically significant positive correlation (r=0.238*) at 0.05 confidence level between the “unit” variable, which only shows the institution where the participants work, and the “total impact score”. Accordingly, while the participants in the BFED think that the coronavirus epidemic has "little" impact on forestry activities, those in the BNCNP think that it has a "more" impact, and those in the UFED think that it has a "medium" impact. However, no significant correlation was found between the “total impact score” and the duty, age, gender, education level, experience, and tenure of the participants.

On the other hand, whether the total impact score differs according to personal characteristics was checked with the Kruskal-Wallis H Test and different groups were determined by Post Hoc multiple comparison test (Games-Howell) (Table 7).

Table 7
Difference control results of the Covid-19 effect according to personal characteristics

Personal Characteristics	**Forestry Activities**	**Kruskal-Wallis H Test**		**Different Groups According to Post Hoc Multiple Comparison Test** (Groups and rankings within groups are according to importance)				
		Chi-square (χ^2) Value	**DF**	**Different Groups**				
				No	**Group Items**	**$\bar{X}$**	**N**	**%**
1.Unit	Silviculture	13.89**	2	1	BFED, NCNP	1.28	44	62
				2	UFED	1.75	27	38
	Forest Roads	16.57**	2	1	NCNP, BFED	1.20	44	62
				2	UFED	2.06	27	38
	Human Resources Management	7.78**	2	1	BFED	1.87	42	59
				2	UFED, NCNP	2.35	29	41
2.Duty	The level of impact of the Covid-19 epidemic on forestry activities is not different according to the duty.							
3.Age	The level of impact of the Covid-19 epidemic on forestry activities is not different according to age.							
4.Gender	The level of impact of the Covid-19 epidemic on forestry activities is not different according to gender.							
5.Eduction Level	The level of impact of the Covid-19 epidemic on forestry activities is not different according to education level.							
6.Experince	Erosion Control and Rangeland Improvement	8.57*	3	1	Those with 21-30 years of experience	1.06	8	11
				2	Those 0-20 years and ≥31 years of experience	1.50	63	89
	Forest Protection and Forest Crimes	7.90*	3	1	Those with 21-30 years of experience	1.38	8	11
				2	Those 0-20 years and ≥31 years of experience	2.22	63	89
7.Tenure	The level of impact of the Covid-19 epidemic on forestry activities is not different according to tenure							

*: Significant at 0.05 confidence level (p<0.01); **: Significant at 0.01 confidence level (p<0.01); DF: Degree of Freedom

According to Table 7, it was understood that the opinions of the participants about the impact of the Covid-19 epidemic on forestry activities differ only according to the unit and experience, not according to the duty, age, gender, education level, and tenure.

According to the unit (BFED, UFED, BNCNP), while the opinions of the participants, especially on silviculture, forest road construction and maintenance, and human resources management, were different at the 99% confidence level, there was no difference between their opinions in terms of wood production, NWFP production, operation and marketing, afforestation and sapling production, erosion control and rangeland improvement, forest cadastre, FVR activities, forest protection, and NCNP activities. While 62% of the total number of participants working at the BFED and BNCNP think that there is no disruption in silviculture activities (youth and density care, spacing and rejuvenation studies) due to the Covid-19 epidemic (based on a 1.28 Likert score), 38% of the participant working at the UFED think that such activities are a little negatively affected (based on a 1.75 Likert score). Similarly, there were differences in the construction and maintenance of forest roads according to the unit studied. While the employees at the BNCNP and BFED think that there is no disruption in the construction and maintenance of forest roads due to the Covid-19 epidemic (based on a 1.20 Likert score), those working at the UFED think that they are a little negatively affected (based on a 2.06 Likert score). There were also differences in the level of 99% confidence between the participants according to the unit on the subject of human resources management. Within the scope of human resources management, while the participants at the BFED think that providing labor, personnel's attendance, their interest in the job and the organization, the productivity of the workforce, the desire of the personnel to work and relocate, etc. are a little affected (based on a 1.87 Likert score), the participants at the UFED and BNCNP think that those are adversely affected a little more (little-medium) than those at the BFED (based on a 2.35 Likert score).

As seen in Table 7, while the opinions of the participants on the effects of the Covid-19 epidemic in terms of their experience are different at 95% confidence level in erosion control and rangeland improvement, and forest protection studies, there is no difference between their opinions on other forestry studies (wood production, NWFP production, operating and marketing, silviculture, afforestation and sapling production, forest roads, forest cadastre, FVR activities, human resources management, and NCNP activities). Accordingly, the participants with 21-30 years of experience (mature people) think that erosion control and rangeland improvement works are never affected (based on a 1.06 Likert score), while those with ≤20 years of experience (young people), and those who make up 89% of the participant and have with ≥31 years of experience (old people) think that such activities are affected very little (based on a 1.50 Likert score). The same thoughts are also valid for forest protection and forest crimes. According to this, mature people with 21-30 years of experience think that forest protection and forest crimes (fire drills, firefighting, fighting insect and fungus pests, illegal tree cutting, transportation, settlement-occupation, grazing, burning, hunting, etc.) are never affected (based on a 1.38 Likert score), young people with ≤20 years of experience and old people with ≥31 years of experience (89%) think that such activities are negatively affected at a "little-moderate" level (based on a 2.20 Likert score). These results show that young and old participants have the opinion that the Covid-19 epidemic has more negative effects than mature participants do.

4. Conclusions and Suggestions

In the study, the impact levels of forestry activities grouped under 12 main headings in the Bartın province from the Covid-19 epidemic were analyzed and evaluated based on the five-point Likert scale survey data obtained from 71 participants employed as managers, technical staff and field personnel at the BFED and UFED and BNCNP. At the end of the study, forestry activities were grouped into four different groups according to their level of being affected by the Covid-19. Accordingly, it was determined that erosion control and rangeland improvement, silviculture, and wood production activities *in the first group* were "never" affected by the Covid-19 epidemic (0%); the construction and maintenance of forest roads, afforestation and sapling production, FVR activities, forest cadastre, and NWFP production, which are *in the second group*, were negatively affected at a "very little" rate (13%); the human resources management, forest protection, operating and marketing activities *in the third group* were negatively affected at a "little" rate (25%); NCNP activities *in the fourth group* were negatively affected at a "medium" level (50%).

In addition, it was understood that the opinions of the participants about the impact of the Covid-19 on forestry activities were different according to the unit and experience, but not according to the duty, age, gender, education level, and tenure. Accordingly, while the participants at the BFED think that the Covid-19 epidemic affects forestry activities "little", those in the BNCNP think that it affects them "more", and those in the UFED think that it affects them "medium" level. According to the unit, while the opinions of the participants on silviculture, forest road construction and maintenance, and human resources management were different at the 99% confidence level, there is no difference between their opinions on wood production, NWFP production, operating and marketing, afforestation and sapling production, erosion control and rangeland improvement, forest cadastre, FVR activities, forest protection, and NCNP activities. Likewise, in terms of the experience of the participants, while their opinions on the effects of the Covid-19 epidemic were different in erosion control, rangeland improvement, and forest protection studies at the 95% confidence level, no difference was found between their opinions on other forestry studies.

In conclusion, although some administrative measures that prevent the spread of health and protect human health were taken in the execution of forestry activities in the province of Bartın during the Covid-19 pandemic period, due to the inadequacy of these measures and the quarantine conditions applied throughout the country, there was been a decrease in the number of participants to recreational activities and auctions (despite electronic auctions), and forest crimes were increased. In addition, it was determined that there were disruptions in the continuation of the staff in the administrative-office works, and the productivity of the workforce decreased. In this context, in order to reduce the negative effects of pandemic periods and to ensure

sustainable forest management, all employees must be properly informed about the effects of the Covid-19 epidemic and the precautions to be taken. The teams that will work in the field should work with a small number of teams in the vehicle, the staff employed in the administrative buildings should work in shifts, and the mask, distance, and hygiene rules must be followed. During the quarantine periods, FVR studies and auctions should be done online, necessary measures must be taken to carry out NCNP activities, and nature-based tourism should be encouraged in terms of the morale and motivation of the society.

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Author Contributions

İsmet DAŞDEMİR planned and directed the research, designed the questionnaire, performed the statistical analysis, and wrote the article.

Merve KIZIL collected the data and assisted in the evaluation of the data and writing the article.

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