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Artículos científicos

Impacto ambiental por el ciclismo de montaña en el bosque La Primavera y una propuesta de educación ambiental

Environmental Impact of Mountain Cycling in La Primavera Forest and an Environmental Education Proposal

Impacto ambiental do mountain bike na floresta de La Primavera e uma proposta de educação ambiental

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Resumen

El ciclismo de montaña es hoy uno de los deportes más practicados. A través de este, los deportistas buscan disfrutar de forma sana el paisaje y estar en contacto con la naturaleza. Sin embargo, esto ha provocado que algunas zonas protegidas se vean saturadas de visitantes, lo cual ha repercutido en el deterioro del medio ambiente. Un ejemplo de ello es el bosque La Primavera, ubicado en Jalisco, México. En sus 11 rutas ciclistas, La Primavera recibe alrededor de 1189 ciclistas por semana, de acuerdo con datos dados a conocer en 2017 (la tendencia indica que el número al día de hoy es mayor). Dicha cifra motivó a que se llevara a cabo una investigación de tipo cualitativa para conocer de manera preliminar el impacto



ambiental que está sufriendo esta zona protegida, en especial en cuatro de las rutas de ciclismo y en una zona de parqueadero de automóviles para los ciclistas que asisten a este bosque. Para alcanzar esta meta, se elaboró una matriz de impacto ambiental que permitió identificar los tipos de impacto, sus indicadores y la intensidad de los mismos. Los resultados muestran que dos de las rutas tienen un impacto alto en cuanto a daño a la vegetación y compactación de suelo; de igual forma, dos de las rutas presenta un impacto alto ocasionado por la erosión; además, tres de las rutas y la zona de aparcamiento presentan un alto impacto sobre la fauna; aunado a ello, tres de las rutas y la zona de aparcamiento presentan un impacto medio causado por contaminación, y finalmente, las cuatro rutas y la zona de estacionamiento presentan un impacto medio en cuanto a la modificación del paisaje. Se concluye que no existe un control adecuado del ingreso de los ciclistas, que no se contempló la capacidad de carga que puede soportar este bosque de una manera equilibrada, que también es necesario un estudio de impacto ambiental más profundo y de tipo cuantitativo con la intención de que se tomen medidas a tiempo, antes de que los daños al ambiente de esta zona natural tan valiosa sean irreparables. También se consideró necesario modificar los reglamentos y exigir su cumplimiento. Y de igual importancia es la recomendación de capacitar a los ciclistas mediante un taller teórico-práctico sobre educación ambiental como requisito para hacer uso de las rutas de ciclismo del bosque La Primavera.

Palabras clave: bosque La Primavera, ciclismo de montaña, educación ambiental, impacto ambiental.

Abstract

Mountain biking is today one of the most practiced sports. Athletes seek to enjoy the landscape and connect with nature in a healthy way. However, this has caused some protected areas to be saturated with visitors, which has had an impact on the deterioration of the environment. An example of this is the La Primavera forest, located in Jalisco, Mexico. In its 11 cycling routes, La Primavera receives around 1189 cyclists per week, according to data released in 2017—the trend indicates that the number today is higher. Said figure motivated a qualitative investigation to be carried out in order to preliminarily know the environmental impact that this protected area is suffering, especially in four of its cycling routes and in the designated automobile parking area for cyclists. To achieve this goal, an environmental impact matrix was prepared that allowed identifying the types of impact, their indicators and

their intensity. The results show that two of the routes have a high impact in terms of damage to vegetation and soil compaction; similarly, two of the routes have a high impact caused by erosion; in addition, three of the routes and the parking area have a high impact on fauna; also, three of the routes and the parking area have a medium impact caused by pollution, and finally, the four routes and the parking area have a medium impact in terms of landscape modification. It is concluded that there is no adequate control of the entry of cyclists, that the load capacity that this forest can support in a balanced way was not considered, that a more profound and quantitative environmental impact study is also necessary with the intention that measures be taken in time, before the damage to the environment of this valuable natural area is irreparable. It was also considered necessary to modify the regulations and demand their compliance. And of equal importance is the recommendation to train cyclists through a theoretical-practical workshop on environmental education as a requirement to use the La Primavera forest cycling routes.

Keywords: La Primavera forest, mountain biking, environmental education, environmental impact.

Resumo

Hoje, o mountain bike é um dos esportes mais praticados. Com isso, os atletas buscam apreciar a paisagem de maneira saudável e estar em contato com a natureza. No entanto, isso fez com que algumas áreas protegidas ficassem saturadas com os visitantes, o que teve um impacto na deterioração do meio ambiente. Um exemplo disso é a floresta La Primavera, localizada em Jalisco, México. Em suas 11 rotas de ciclismo, La Primavera recebe cerca de 1.189 ciclistas por semana, de acordo com dados divulgados em 2017 (a tendência indica que o número hoje é maior). Essa figura motivou uma investigação qualitativa a ser realizada, a fim de conhecer preliminarmente o impacto ambiental que esta área protegida está sofrendo, principalmente em quatro das ciclovias e em uma área de estacionamento para ciclistas que participar dessa floresta. Para atingir esse objetivo, foi elaborada uma matriz de impacto ambiental que permitiu identificar os tipos de impacto, seus indicadores e intensidade. Os resultados mostram que duas das rotas têm alto impacto em termos de danos à vegetação e compactação do solo; da mesma forma, duas das rotas têm um alto impacto causado pela erosão; além disso, três das rotas e a área de estacionamento têm um alto impacto na fauna; Além disso, três das rotas e a área de estacionamento têm um impacto médio causado pela

poluição e, finalmente, as quatro rotas e a área de estacionamento têm um impacto médio em termos de modificação da paisagem. Conclui-se que não há controle adequado da entrada de ciclistas, que não foi considerada a capacidade de suporte que essa floresta pode suportar de maneira equilibrada, que também é necessário um tipo mais profundo e quantitativo de estudo de impacto ambiental com a intenção que medidas sejam tomadas a tempo, antes que os danos ao meio ambiente desta valiosa área natural sejam irreparáveis. Também foi considerado necessário modificar os regulamentos e exigir sua conformidade. E de igual importância é a recomendação de treinar ciclistas por meio de um workshop teórico-prático sobre educação ambiental como requisito para o uso das rotas de ciclismo florestal La Primavera.

Palavras-chave: Floresta La Primavera, mountain bike, educação ambiental, impacto ambiental.

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Introduction

La Primavera forest is a large area located in the Mexican state of Jalisco. Since 1934 it has been granted various declarations as a protected natural area, both at the federal and state levels. Among the most recent, in 1980, as a forest protection area and refuge for wild fauna, and in 2000, as a flora and fauna protection area.

La Primavera Forest is around 140,000 years old. It is the consequence of volcanic eruptions, from which pyroclastic products with an area of 700 km² arose. With 30,500 hectares, it is the largest reserve that the city of Guadalajara has, (Government of the state of Jalisco, 2019).

This reserve is located in the center of a set of valleys, such as: Tesistán, Tala, Toquilla, Atemajac and San Isidro Mazatepec, which belong to the Guadalajara municipalities of Arenal, Tala, Tlajomulco de Zúñiga and Zapopan (Rodríguez et al., 2010).

This thick forest functions as a habitat for numerous species of flora and fauna, as well as a genetic reservoir and biological corridor. Proof of this is that there are four important different types of vegetation: the oak-pine forest, the pine forest, the oak forest and tropical deciduous forest, as well as three plant communities: the riparian, the rupicola and the ruderal, as well as it has more than a hundred different plant species, such as the agave or maguey, the Dhalia, the Mammillaria and the white poplar.

As for the fauna, it has more than 60 species of mammals such as the puma, coyote, deer and the cacomixtle, various species of bat, more than 49 species of reptiles, 20 of amphibians, more than 250 species of birds such as the woodpecker , numerous species of invertebrates such as butterflies, bees and beetles, in addition to seven species of fish; All of these fulfill important functions such as pollination, biological controls, seed dispersers and indicators of the ecological balance of the ecosystem.

Being very close to the Guadalajara Metropolitan Area (ZMG), it provides a series of ecosystem services, among them, an important source of oxygen, a regulation of the temperature and humidity of its environment, which provide a better quality of life. its inhabitants.

One of the various activities offered by Bosque La Primavera is mountain biking, which has been carried out for more than 30 years. With mountain biking you can enjoy the landscape in a healthy way and be in contact with nature. However, in recent times, the influx of cyclists has increased considerably, which has been causing an increasing environmental impact on the forest. It should be noted that La Primavera forest has eleven official routes for mountain biking; They all have their main access through the control booth located at the end of Avenida Mariano Otero, in the municipality of Zapopan, where a large number of cyclists converge Sunday to Sunday.

Thus, as the populations of the ZMG grow, this valuable natural resource is increasingly under pressure from athletes, which alters the ecological balance and the degradation of these systems and causes an environmental impact.

At this point, it is worth mentioning that environmental impact is defined as the alteration of the quality of the environment produced by human activity (Garmendia, Salvador, Crespo and Garmendia, L., 2005). Caused by the continuous presence of people in natural areas, it causes the breakdown of the ecological balance due to the modification of the habitat of biodiversity, and consequently, it generates stages of degradation of the communities, which allows the invasion of species not typical of those ecosystems , in addition to producing imbalances in the species, since they are not used to human presence. As a result of the above, there is a decrease in reproduction rates, difficulty in predation chains, as well as excess environmental burden. (Picornell, 1993).

According to Pérez (2008), Luque, Baena and Granero (2011), Farías (2015), Carrasco and Enríquez (2016) and Rebolledo (2020), mountain biking generates an environmental impact on various elements of the ecosystem, namely:

- Regarding the vegetation, the growth of the vegetation cover decreases, so its reproductive capacity is weakened and the ages and changes in the plant communities are altered, in such a way that the species that are more resistant to this begin to proliferate. type of impacts and, therefore, the modification of microclimates and the loss of surface vegetation.
- With regard to soil compaction, there is a destruction of the surface layer, which is mainly made up of organic matter, as well as an alteration in the edaphic horizon, soil compaction, and the alteration of basic functions performed by the soil. , such as aeration, temperature control, edaphic fauna, soil texture, nutrient regulation, reduction of water filtration capacity towards the groundwater table, increase in surface water and consequently ponding .
- With regard to soil erosion, once the surface layer or O horizon has been lost, which is made up of leaves, branches and plant remains, the layer called A horizon is also lost, where the herbaceous vegetation takes root. . Once these two horizons are lost, the process of erosion and eluviation begins, in which the elements of the rest of the layers are detached: the soil is totally infertile.
- Regarding the fauna, there is a decrease in the quantity and quality of the habitat, since those who make it look for areas further away from the presence of people; there are alterations in their reproduction and, consequently, a change in their habitual behavior. Likewise, the presence of food residues from athletes must be considered, residues that can modify the diet of the animals or cause their death.
- With regard to soil and air pollution, this alteration occurs when garbage and food remains are left on the ground. Gases from combustion engines or noise from people or vehicles can also be observed in the atmosphere, which are not part of that ecosystem.
- With regard to the modification of the landscape, the environmental impact occurs when there is a certain intensity of use of the territory by human activity, which exerts constant pressure, an act that deteriorates the landscape, or modifies it, which may or

may not be resilient according to the capacity of their biotic communities to absorb or withstand disturbances (Guzmán y Guzmán, 2012).

According to a journalistic note from Camacho (February 26, 2017), according to the Decentralized Public Organization (OPD) of La Primavera forest, 2016 closed with a total of 57,109 cyclists who made use of the space, which represents an income of 1189 athletes per week. As has been seen, as this figure increases, the vulnerability of La Primavera Forest increases, which is why the interest in carrying out this research on the environmental impact suffered there was originated, since to date it must the number of cyclists attending this forest is much greater.

Methodology

This was a qualitative, descriptive research, since, as Best (1982) mentions, what is, or what exists, is interpreted or described and is related to a preceding event that has influenced or affected a present condition or events. In this case, he sought to describe the qualitative environmental impact that has been generated in the La Primavera forest due to mountain biking.

In this study, the aim was to carry out a preliminary qualitative environmental impact assessment, which is simple and is used to draw attention to the most important impacts that may have repercussions later (Conesa, 2009).

Observation technique was used to collect data. Following Grinnell (1977), cited in Hernández, Fernández and Baptista, (2014), the observation technique seeks to explore environments, contexts, subcultures or social aspects.

It is worth mentioning that for the evaluation of environmental impacts there is no general methodology that can be applied to all types of projects, therefore, methodologies should be considered as instruments that can facilitate the environmental impact evaluation process. That is why each methodology must be adapted to the project in question, which are known as ad hoc method (Oyarzún, 2008; Vera, 2015).

And in this sense, a matrix was constructed as an instrument taking as references the simple checklist recommended by Viloría (2015), which consists of a list of possible impacts, the simple scale checklist by Arboleda (2005), the which, apart from showing a list of possible impacts, adds a scale of values of environmental variables, which allows a subjective appreciation of the magnitude of the change that may occur, and the model of Andrés, Del

Cerro and Benayas (2000), qualitative model for the identification of impacts that relates the degree of environmental impact of the activities, the level of use and the vulnerability of the environment (this matrix is presented in Table 1).

This matrix contains the criteria that were taken into account as principles for this evaluation, as well as the indicators that specified the criteria, which allowed establishing the intensity of the observable environmental impact. The total number of cycling routes is 11, but in this instrument only four of them were taken into account, because they were the ones that allowed us to investigate, since we had to count on the company of forest rangers to avoid getting lost in the routes. Similarly, a parking area for cyclists' vehicles was also investigated, as it was considered important to take it into account due to the environmental impact it generated.

The investigated routes

- The fly: it has a length of 4 km and is considered of medium difficulty.
- Garrison: it is 2.3 km long; considered of medium difficulty.
- Slides: it has a length of 2.6 km and is considered of advanced difficulty.
- El espinazo del diablo: it has a length of 2 km and is considered of advanced difficulty, according to data from the La Primavera forest website (Government of the State of Jalisco, 2019).
- The parking space, which is known as Eight and a half, which is located inside the forest and 2 km from the access booth on Avenida Mariano Otero.

For the development of this research, eight routes were carried out, one per day, each lasting six hours, which were done on foot and on Sunday, the day with the highest number of cyclists in this forest.

Results

Next, the prepared matrix is presented (figure No. 1), which allowed the collection of data, which shows the intensity of the impact in each space: the red color indicates that the impact is high, the yellow color that the impact is medium and the blue color that the impact is low. The foregoing under the understanding that these evaluations must be complemented

with quantitative assessments, since, as mentioned above, a qualitative assessment of preliminary environmental impact was carried out.

Tabla 1. Matriz del impacto ambiental por el ciclismo de montaña en el Bosque La Primavera

| Criterio | Indicador | Rutas de ciclismo y zona de estacionamiento de vehículos | Impacto alto | Impacto medio | Impacto bajo |
|--|---|--|--------------|---------------|--------------|
| Efecto adverso sobre la vegetación | Los participantes en este deportes rompen a su paso plantas y dañan las raíces de los árboles que se extiende sobre el suelo descubierto debido a la erosión | Ruta la mosca | | | |
| | | Ruta Garrison | | | |
| | | Ruta toboganes | | | |
| | | Ruta espinazo del diablo | | | |
| | | Parqueadero | | | |
| Efecto adverso sobre la compactación del suelo | L estructura del suelo se compacta debido al paso continuo de la rodada de las bicicletas , a la falta de porosidad par aeración de a tierra de dren de la misma , causando una permeabilidad y por consiguiente acumulación de agua | Ruta la mosca | | | |
| | | Ruta Garrison | | | |
| | | Ruta toboganes | | | |
| | | Ruta espinazo del diablo | | | |
| | | Parqueadero | | | |
| Efecto adverso sobre la erosión del suelo | La superficie del suelo es desgastada como consecuencia de la fricción del rodado de las bicicletas lo cual causa desprendimiento de la misma perdiéndose la capa de materia orgánica perdiendo además su capacidad de filtrado generando arrastre del agua e inundaciones convirtiéndose en zonas no aptas para la vida. al igual la pendientes donde se | Ruta la mosca | | | |
| | | Ruta Garrison | | | |
| | | Ruta toboganes | | | |
| | | Ruta espinazo del diablo | | | |
| | | Parqueadero | | | |

| | | | | | |
|---|---|--------------------------|--|--|--|
| | presenta este fenómeno tienes un alto porcentaje de declive en relación al permitido. | | | | |
| Efecto adverso sobre la fauna | La velocidad a la que viajan algunos colistas es muy alta, esto no permite que especies que se crucen en el camino alcancen a escapar, así también los ruidos de estas perturban la vida de la fauna lo que los obliga muchas d las veces a buscar otros refugios más distantes. Asía también el hecho de que pongan cercas de alambre de púas y de malla ciclónica propicia un aislamiento de los animales impidiendo así la reproducción de los mismos Al igual el ruido de las ciclistas que viajan gran velocidad perturba a esta especies. | Ruta la mosca | | | |
| | | Ruta Garrison | | | |
| | | Ruta toboganes | | | |
| | | Ruta espinazo del diablo | | | |
| | | Parqueadero | | | |
| Efecto adverso sobre la contaminación del suelo | Muchas de las veces los ciclistas descansan en algunas zonas de las rutas en las cuales es común encontrar restos de comida, bolsa y empaques de alimentos, que pueden cambiar la dieta de la fauna que vive ahí o causar su muerte y en el caso de los restos no degradables duraran muchos años para que se desintegren | Ruta la mosca | | | |
| | | Ruta Garrison | | | |
| | | Ruta toboganes | | | |
| | | Ruta espinazo del diablo | | | |
| | | Parqueadero | | | |
| Efecto adverso sobre | La zona de aparcamiento de | La mosca | | | |
| | | Ruta Garrison | | | |

| | | | | | |
|---|--|--------------------------|--|--|--|
| emisión de ruido | personas que llegan en vehículos causa un gran ruido ya que hacen presencia alrededor de 200 autos los días domingos que es el de mayor afluencia, perturbando la vida de la fauna. Así también la velocidad de los ciclistas o las conversaciones en grupo en zonas de descanso alteran la tranquilidad de las especies animales | Ruta toboganes | | | |
| | | Ruta espinazo del diablo | | | |
| | | Parqueadero | | | |
| Efecto adverso sobre la contaminación de la atmosfera | La llegada de vehículos a la zona de aparcamiento genera contaminación por los gases de combustión | La mosca | | | |
| | | Ruta Garrison | | | |
| | | Ruta toboganes | | | |
| | | Ruta espinazo del diablo | | | |
| | | Parqueadero | | | |
| Efecto adverso sobre la Modificación del paisaje | En las rutas oficiales se han encontrado una diversidad de desviaciones que los propios ciclistas han hecho para hacer atajos , al igual han incorporado objetos en los senderos como pedazos de madera , de alfombra, tapetes para hacer más difíciles y emocionantes las rutas, al igual los dueños de terrenos ejidales han puesto cercas de alambres de púas y mallas ciclónicas para evitar que entrena a sus terrenos los ciclistas , lo cual ha causado un modificación del paisaje | La mosca | | | |
| | | Ruta Garrison | | | |
| | | Ruta toboganes | | | |
| | | Ruta espinazo del diablo | | | |
| | | Parqueadero | | | |

Fuente: Elaboración propia tomando como base en Arboleda (2005), Andrés *et al.* (2000) y Vilorio (2015)

Adverse effect on vegetation

On the routes of La mosca and Garrison, a medium impact of the vegetation could be observed due to the fact that it is trampled by the rolling of the tires, which has caused the decrease of the plant population, in some areas there are no plants and also note denudation of tree roots.

Regarding the Toboganes and El espinazo del diablo routes, they present a high impact, the surface layers of the soil do not even exist: they are totally eroded; here too the path is crossed with bare tree roots.

Regarding the car park, a medium impact is observed on the vegetation, which is injured by the passage of people and the rolling of car tires, although the intensity is lower than on the routes of La mosca and Garrison, since Only cyclists have access to this area on Sundays.

Adverse effect on soil compaction

In the La mosca and Garrison routes, a medium impact was observed due to soil compaction, since in an important part of this route the soil is flattened and without vegetation.

In the case of the Toboganes and El espinazo del diablo routes, there is a high impact due to soil compaction, since the first layers of it do not even exist: the route is totally eroded.

In the case of the parking lot, it also observes a medium impact due to soil compaction, because in parts the absence of vegetation is observed due to the rolling of vehicles.

Soil erosion effect

On the La mosca and Garrison routes, a low impact in terms of erosion was observed, since most of these routes do not present very marked slopes; they still retain the first layers of soil.

Regarding the Toboganes and El espinazo del diablo routes, a high impact was found: cycling activity has completely ended with the first layers of the earth, the presence of animal

and plant remains is nil; only clay, stones and sand are observed. Likewise, this phenomenon contributes to the high decline that the routes have, far from the 10% recommended for this activity, which even causes stones to fall.

Regarding the parking area, a low impact due to erosion was found: it conserves the first layers of soil and is flat.

Adverse effects on fauna

Through the route that was made on the routes La mosca, Garrison and Toboganes and in the parking area, the death of any species of animal was not observed. However, it was impossible to hear the sound of any bird or other species. It is evident that animals move away in the presence of the noise of people and vehicles, so it is considered high impact.

Regarding the route El espinazo del diablo, which is the most remote route, of high difficulty and which is much higher above sea level than the others, and therefore, it does not have much influx of cyclists. On this route, we said, it was possible to hear the songs of various species of birds, observe squirrels and some reptiles; consequently, its impact on fauna was considered of medium intensity.

Effects of contamination

During the route of the La mosca and Garrison routes, several points were found with food remains, plastic bags and papers contaminating the ground. In addition, it was more common to hear sounds of people's voices and the noise of bicycles, so its impact on pollution is considered medium.

On the Toboganes route, the remains of food and garbage were minimal, but it was more frequent to hear the sound of the high speed of cyclists, since this route has a significant decline, so it was considered medium impact.

Regarding the route El espinazo del diablo, the remains of food and garbage were found, as well as noises that revealed the presence of cyclists; its impact was considered low intensity.

While in the parking area the pollution of the atmosphere was observed by the emission of gases from cars and by the noise of people, so it was considered of medium impact.

Effect on landscape modification

On the routes of La mosca and Garrison, it was found that some sections had been widened by traveling as a couple, in such a way that at times it seemed like gap roads, not cycling routes. Likewise, multiple deviations were observed on these routes, which gave rise to alternate trails that invade private properties. Numerous objects not belonging to the ecosystem landscape were also observed, such as wooden boards, pieces of carpet and bricks, which were used to form ramps with the intention of making the sport more exciting. Other important things found that modified the landscape were barbed wire borders, and cyclone mesh borders very close to cycling routes, so the modification of the landscape was considered of medium impact.

Regarding the Toboganes and El espinazo del diablo routes, there were very few objects found that modified the landscape. Among these were also pieces of boards to make ramps. And as in the other trails, alternate routes to the official one were found, so the modification to the landscape was considered of medium impact.

With regard to the parking area, barbed wire boundaries were found to delimit the area where cars could be parked, which has an area of approximately 2000 m²; The modification to the landscape was considered of medium impact.

Discussions

When a protected natural area is near a large city, as is the case of the forest analyzed here, it faces various risks: increasing the number of people engaging in the different activities it offers, including mountain biking, which day by day it has more followers.

Carrying out an environmental impact assessment is important since it allows knowing the levels of damage, which provides elements to establish programs and actions for correction, mitigation, prevention, follow-up and monitoring in order to achieve an ecological balance in this natural area. protected.

It must be taken into account that the environmental impact of the La Primavera forest in mountain biking areas is not only determined by the excess of people who enter, but also by the wrong actions of the athletes and by the vulnerability of the elements that make up its ecosystem.

This qualitative and preliminary environmental impact assessment makes it clear that there is no appropriate entry control of athletes to this area, since they introduce objects that

integrate the routes and modify the landscape, such is the case of wooden boards, brick and rugs.

Likewise, it is notorious that the carrying capacity that this forest can support was not taken into account, since there is no limit number of athletes to enter, which has contributed to the formation of alternate routes, to the compaction of the trails, to the loss of vegetation and in some routes to a serious erosion.

It is equally obvious that when scheduling this mountain biking project in the La Primavera forest, an optimal use of its natural resources was not planned, nor were the physiobiological characteristics of the forest taken into account, since if this were the case, this environmental impact would not occur. In addition, following Luque (2003), it is considered that any type of activity seeks sustainability, which implies not degrading natural resources or depleting them, but rather seeking an orderly use of the elements that serve as support, for which it is necessary that human activities are distributed in tune with the physical, biological and perceptual characteristics that exist in space.

In this sense, it is considered transcendental to carry out other more in-depth environmental impact assessment investigations, especially quantitative ones, which allow us to know exactly the fragility of the ecosystem and the potential for impact generated by this sport. This with the intention of carrying out projects that prevent the environmental deterioration that is clearly observed from continuing to advance, before the negative changes can be irreversible.

In addition, it is necessary that there are clear, adequate and sufficient regulations that lead the athlete to have an attitude of respect and responsibility towards this ecosystem; but above all, seeking to change the cyclist's mentality through environmental education, since changing his behavior will modify the environmental impact of La Primavera.

It is important to mention that, to solve this environmental impact, actions are required that correspond to different areas, for example, the improvement of regulations and their correct application, as already mentioned, better methods of entry and control, a better system of vigilance, proper administration, but above all to educate cyclists environmentally. Taking this last point into account, the following proposal is made.

Environmental education proposal

All environmental impact is linked to environmental education, ecological culture and the responsibility of society. Recent studies have shown that ecological culture is related to the knowledge that human beings have of the environment, the value they place on the environment, the way they use natural resources and the level of sustainability they seek to achieve. . Thus, an environmental knowledge permeated by interdisciplinarity is necessary that allows people to understand the multiple causes and interdependence of the processes and phenomena that lead to environmental change (González, 2015; Juan, 2016; Leef, 2004, cited in Juan, 2017).

And following Hammitt and Cole (1998, cited in Farías and Sallent, 2009), environmental impacts do not depend on a single factor but on several, and among these are the characteristics of the practitioner, for example, the degree of awareness and commitment towards the environment. In this sense, it is necessary to carry out a theoretical-practical environmental education workshop for cyclists that provides knowledge aimed at understanding the complexity and operation of the forest ecosystem, the different living beings that inhabit it and their relationship between them. , the importance of inert elements and their interaction with the rest of organisms, the different cycles that develop and above all the importance of the balance of this protected area to continue conserving the different forms of life, including ours.

Once cyclists have knowledge, they will be able to analyze how their activities impact the environment, and how they can avoid it, reflection that will lead them to a change in attitudes and, consequently, to the development of environmental values, so necessary today.

The themes to address in the workshop

- The living elements of the forest.
- The inert elements of the forest.
- Interactions between living and inert elements of the forest.
- Food chains.
- Food networks.
- The biogeochemical cycles that develop in the forest.
- The ecological balance in the forest.
- The environmental impact on the forest and its consequences.

During the application of this workshop, it is suggested to carry out meaningful learning strategies, direct and mediated knowledge strategies and field practices as interpretive paths. And for this, it is suggested to request support from the University Center for Biological and Agricultural Sciences of the University of Guadalajara, which has trained personnel who have always been interested in the La Primavera forest.

Finally, the creation of the Asociación de Ciclistas del Bosque La Primavera is suggested, with the intention that they carry out activities to care for the forest environment, as well as monitor the proper use of cycling routes and be multipliers of the workshop presented here for newcomers to the forest cycling routes.

Conclusions

Once the results of the qualitative and preliminary evaluation are known, it is clear that it is important to take precautionary measures, since, if cyclists continue with the same practices, they will eliminate all the vegetation on the official routes, and also of the worrying and numerous alternative routes that they have mistakenly created. When vegetation is lost, there will no longer be conditions for other forms of life to develop, mainly microorganisms that play a determining role in the biogeochemical cycles of the ecosystem.

In the same way, the compaction that the soil of the official and alternate routes presents must be addressed as soon as possible, since if it continues in these circumstances it will end with erosion processes, some of which are already worryingly appreciated in two of the cycle routes. This erosion increases every day due to the constant friction of the passage of cyclists and the passage of water in times of rain, which causes the layers of soil to continue to wash away day by day and these paths deepen.

Likewise, the invasion of the habitat of the different animal species, through the continuous passage of bicycles through the official and alternate cycling routes, and the noise of people, have caused them to move away; they have been forced to seek more remote refuges, which leads to very important behavioral changes both for mating and for reproduction, and above all, species are put in danger of extinction.

On the other hand, the fact that there are food remains and solid waste endanger the integrity of the different animal species, since it can cause a change in their diet, or suffer accidents with inorganic waste. In addition to this, the emission of gases from vehicles can affect the health of the different forms of life that inhabit that place.

It is evident that there is not an adequate review of cyclists at the time of entering, since they introduce objects that modify the natural structure of the landscape, in addition to that they have motivated private property owners to install fences with barbed wire or cyclonic meshes to Avoid encroaching on your grounds by creating alternate routes. This form of delimitation of the territory has repercussions forming an isolation between the animal species, which consequently brings about alterations in the reproduction and danger of extinction of these.

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