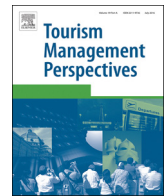




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## Tourism impact assessment: A tool to evaluate the environmental impacts of touristic activities in Natural Protected Areas



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### ABSTRACT

Tourism may be an ally or a threat to conservation. The expansion and diversification of tourism had an increasing environmental impact on protected ecosystems. Therefore, it is important to assess and anticipate the potential impacts of tourism on Natural Protected Areas (NPA), to articulate the public use of NPA and their conservation. The Tourism Impact Assessment (TIA) is a methodology for evaluating the environmental impacts associated with tourism in NPA. We tested TIA on three NPA of the National Protected Areas System of Uruguay. We identified fifteen main tourist activities that can affect four biological components (i.e., biodiversity, plant coverage, soil and water), and 21 potential impacts. The severity of these impacts was evaluated for each area based on expert consultation. We conclude that TIA is a practical tool to assess, monitor and prevent tourism impacts in NPA that can be used to reach a sustainable tourism management.

### 1. Introduction

Intensive use of ecosystems can generate a reduction in the provision of benefits that the ecosystems provide (ecosystem services), a greater chance for non-linear risks and an increase in poverty and inequality (Reid Walter et al., 2005). These effects decrease the benefits that future generations can obtain from ecosystems (Chapin III et al., 2000). Thus, one of the strategies for conservation applied worldwide is the establishment of Natural Protected Areas (NPA). In these areas, the use of natural resources is planned and managed to reach specific objectives for the conservation of certain conditions or processes, such as wild species populations, habitat, the natural landscape or diverse aspects of biocultural heritage (Boege, 2008; UN – UNITED NATIONS, 1992; Pohlenz et al., 2013). Worldwide, a total of 217,155 protected areas have been established, covering 14.7% of the terrestrial surface and 4.12% of the total marine area on the planet (UNEP-WCMC and IUCN, 2016).

Tourism can be a threat or an ally for conservation in NPA, depending on its compatibility with conservation objectives, which can be determined by management planning (Balmford et al., 2009; Deguignet et al., 2014). Globally, tourism is one of the most important economic and social phenomena of the 21st century, characterized by a rapid expansion of the industry and by the growing tendency of tourists to visit new destinations (WTO, 2016). According to the World Tourism

Organization (WTO), 25 million of tourists traveled internationally in 1950, compared to 674 million tourists in 2000 and 1186 million in 2015 (WTO, 2017). The economic resources generated by tourism also increased, going from 2000 million in 1950 to 495,000 million in 2000 and 1,260,000 million in 2015 (WTO, 2017). According to the WTO (WTO, 2016), in countries that emit great numbers of tourists, like European and North American countries, there is a tendency among tourists to seek out tourism focusing on experiences, adventures and visiting “authentic sites”. For this reason, Asia, Africa and Latin America, continents with great natural patrimonies, have become touristic spotlights of the world (SCDB – Secretariat of the Convention on Biological Diversity, 2015).

Tourism used to be a massive phenomenon concentrated in coastal zones and in summer time, following a “sun and beach” model. During the last few decades, tourism has experienced substantial expansion and diversification (MINTUR – Ministerio de Turismo y Deporte de Uruguay, 2009; SCDB – Secretariat of the Convention on Biological Diversity, 2015). A new type of tourism arose from this process of expansion, known as ecotourism (Riveros & Blanco, 2003; WTO, 2002), which is defined as “all forms of tourism based on nature and in which the tourist's main motivation is the observation and appraisal of nature or the traditional cultures predominant in the natural zones” (WTO, 2002). In countries that receive tourists mainly during summer time around the coast fringe, like Uruguay, ecotourism development could

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contribute to expand the zones and seasons of tourism. Due to growing demand, the number and diversity of the localities and products linked to ecotourism increased (Barrera, 2006; Reid Walter et al., 2005).

Protected areas worldwide receive almost eight million visitors annually, which generate revenues up to 600 million dollars per year in receiving countries (Balmford et al., 2015). Tourism in protected areas should be framed within ecotourism principles and should contribute to reach the conservation targets of the area (Eagles et al., 2002). Given that biodiversity is one of the main ecotourism attractions, there is an urgent need of tools to prevent negative environmental impacts of tourism-related activities (SCDB, 2015; Marion et al., 2016). In addition, to ensure that ecotourism can contribute to the long-term conservation goals of protected areas, tourism activities should be properly monitored, assessed and managed (Das & Chatterjee, 2015).

The contribution of tourism to conservation goals can be achieved through the tourist's interest towards understanding of the natural environment and the protection of natural and cultural heritage (Andy & Moore, 2005; Das & Chatterjee, 2015; López Bonilla & López Bonilla, 2008). However, not all tourism activities carried out in protected areas generate tourist's conservation concerns (Geffroy et al., 2015; Pickering & Hill, 2007; Zhong et al., 2015). Thus, it is important to understand the benefits as well as the negative impacts that tourism may have on the environment, society and the economy in order to develop appropriate management plans that correspond with long-term sustainability goals (Eagles et al., 2002; Job et al., 2017). Some of the main negative impacts related to touristic activities on protected areas include changes on land cover and land use, an increase in the demand of natural resources, pollution, urbanization and acquisition of land by new actors, changes in the structure of resource management, infrastructure creation, an increase in volume of waste produced, and an amplification of local inequality ((Andy & Moore, 2005; Cañada & Gascón, 2007); López & López, 2008).

Two approaches have been widely used to assess and manage the negative impacts of tourism: Tourism Carrying Capacity (TCC) and Limits of Acceptable Change (LAC) (Bentz et al., 2016; Bera et al., 2015). The TCC is defined as “the maximum number of persons that can visit a tourism destination at the same time, without causing destruction of the physical, economic and social-cultural environment nor an unacceptable decrease in the quality of the visitor satisfaction” (WTO, 1982). In synthesis, this concept tends to establish a limit on touristic activity according to the priorities of local managers and planners (Coccosis & Mexa, 2017; Echamende Lorente Pablo, 2001). The weakness of this management tool stems from a basis on a fixed number, calculated for a certain time and under certain conditions. Therefore, it is not flexible in response to temporal changes both in environmental and social conditions (Calderón, 2016), but nonetheless has remained as one of the most frequently used techniques (Bera et al., 2015). In contrast, the LAC focuses on setting thresholds of acceptable changes under environmental settings, and requires the definition of indicators, standards and monitoring programs to assess the magnitude of changes (Boyd & Butler, 1996). This approach uses both biophysical indicators and users' perceptions as potential inputs for assessment and monitoring (Bentz et al., 2016). One of the most important features of the LAC approach is that it contemplates the necessary actions to protect desirable conditions through a systematic, explicit, justifiable and rational process (Andy & Moore, 2005; Eagles et al., 2002). However, the process of defining limits of acceptable change faces crucial challenges like insufficient data, limited understanding of the natural variability, limited understanding of ecosystems or species resilience, and lack of understanding of what would actually constitute a change in ecological character (SEWPAC, 2012). Although these approaches have been successfully implemented in protected areas, there is still a need for a more flexible and practical tool.

## 2. The tourism impact assessment method

Traditionally, assessing environmental impacts begins with a detailed identification of pressures and system components, following by the identification and the classification of impacts according to their magnitude (EPA, 1992; EPA, 1998; Fernández-Vítora, 2009; Granizo et al., 2006; IAIA, 1999). This method has been widely used in environmental impact assessments to understand the negative impacts of infrastructure or extraction projects. Some of the principal limitations that have been recognized for this method are: it accommodates both quantitative and qualitative data; it does not distinguish between immediate and long-term impacts; and it aggregates in a single method various ecosystem changes that may not be comparable (Bowd et al., 2015). However, Leopold matrix provides a methodological framework flexible rather than arbitrary that can be potentially adapted to a broad spectrum of circumstances. In this study, we adapted the Leopold matrix method (Leopold, 1971), to develop an efficient and practical tool to determine environmental impacts caused by touristic activities in protected areas based on expert consulting.

The Tourism Impact Assessment (TIA) has five main advantages to previously described methods: 1) the application of the TIA does not require an expert, so it can be used by a wide range of actors related with the area like members of the community, government, enterprises or nongovernmental organizations; 2) it can be used to assess both the potential and the already occurred impacts; 3) it is based on the perception of local experts that are in constant interaction with the environmental components; 4) it does not take into account the users perceptions, prioritizing environmental conditions over user's experiences; 5) it is a flexible and practical tool that can be easily used as part of a monitoring program to guide tourism management and avoid irreversible deterioration. Additionally, we validated the TIA on three areas within the National System of Protected Areas of Uruguay (SNAP in Spanish). We selected the Laguna de Rocha Protected Landscape (LRPL), Quebrada de los Cuervos Protected Landscape (QCPL) and Cabo Polonio National Park (CPNP) to obtain a representative sample in terms on tourism activities and ecosystems. The application of this method could lead to better tourism planning and management that aims to conserve the components and functions of Natural Protected Areas.

## 3. The four steps of the TIA

### 3.1. Step 1: identification of pressures (touristic activities)

The first stage consisted in identifying all the tourism-related activities in the study area. In this study, we revised the Management Plans, or management plan drafts, of the 14 protected areas included in the SNAP in Uruguay. Then we conducted interviews with the directors and staff in charge of the areas to elaborate a full list of touristic activities. The interviews were conducted using a semi-structured approach (Ander-Egg, 2003) with two steps: (1) we sent the interview guidelines via email, and then we contacted the interviewee via telephone to schedule a face-to-face meeting; (2) during the face-to-face meeting we performed semi-structured interviews and included time to receive additional comments.

### 3.2. Step 2: selection of ecological components

To keep it simple, the ecological system of the protected areas that could suffer the pressures of tourism was segregated in four components, two abiotic (soil and water) and two biotic (biodiversity and plant coverage). However, it is important to point out that the definition of ecological components can be as exhaustive as each area requires it to be useful for its management. This allows for more flexibility in an adaptive management context.

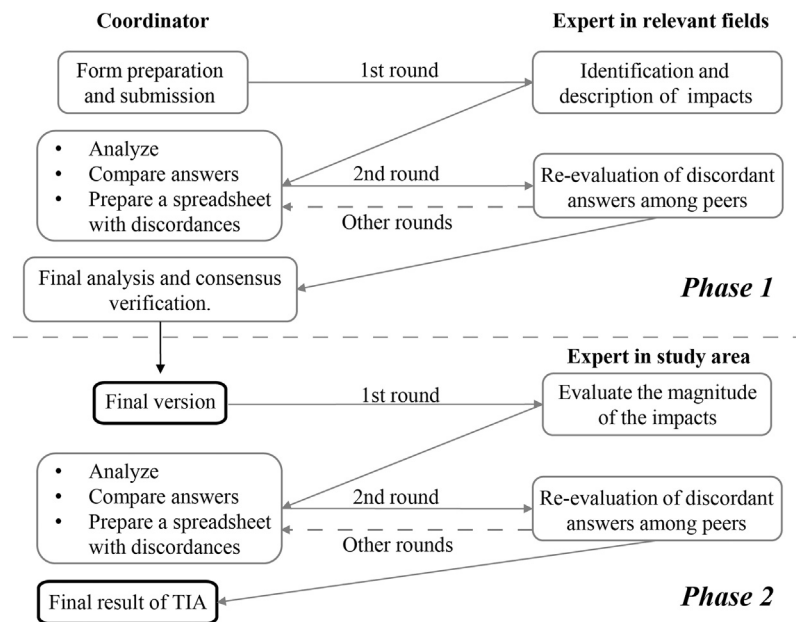


Fig. 1. Method used to the expert consulting.

3.3. Step 3: identification and description of impacts

From steps 1 and 2, a Leopold matrix of pressures vs. components was built. The result from the matrix enabled the identification of the impacts of each pressure on each component. After identification, a clear description of each impact was made. This is an important step, and as such is performed by consulting (Alicia, 2008; Andy & Moore, 2005; Granizo et al., 2006; López Bonilla & López Bonilla, 2008; SCDB – Secretaría Del Convenio Sobre La Diversidad Biológica, 2004) a group of experts (the first group) which are specialized in ecological components (Fig. 1). The method used to obtain expert opinions is explained below.

3.4. Step 4: establishment of criteria to evaluate the magnitude of the impacts

The magnitude of each impact was determined by integrating the pressure severity, the component's vulnerability and the management capacity of the protected area. Thus, the magnitude of the impact increases as the severity of the pressure and the vulnerability of the ecosystem increases; whereas the magnitude decreases with the management capacity of the area. Pressure severity is related to the frequency and extent of the touristic activity. Ecosystem vulnerability depends on the sensitivity of the biota, as determined by the number of endangered, priority or rare species present in the area. The management capacity of the area depends on the availability of approved management plans, and the required human and economic resources to implement the corrective actions. Following these general criteria, the magnitude of each impact was evaluated by the second group of experts (Fig. 1), which are in constant interaction with the ecological components of each protected area, using three levels of impact (low, medium and high).

3.5. Expert consulting

As mentioned above, the impact identification (step 3) and the evaluation of magnitude (step 4) were carried out through expert consulting. Additionally, feedback from experts was also incorporated during steps 1 and 2. To guarantee the effectiveness of the consulting, the Delphi method was used, in which there is feedback between the consulting coordinator and the consulted experts to achieve a result

where all opinions and discrepancies are considered (Mitroff & Turoff, 1975). The expert consultation included two phases, first were consulted experts on ecological components, and then experts on the study area (Fig. 1).

3.6. Phase 1

During the identification and description of impacts (step 3), the first group of experts was consulted. Members of this group had to be experts in at least one of the following fields: identified ecological components, tourism, conservation and/or Natural Protected Areas. In addition, we considered that expertise should be backed up by at least four years of work in Natural Protected Areas and persons holding a postgraduate academic degree were prioritized. However, this should be considered as a flexible criterium that can vary according to each site. In this study, the consulting began with the selection of three experts of three different sectors: (1) President of a local nongovernmental organization (NGO), (2) regional expert and (3) SNAP technician (Table 1). Two rounds of consultation were carried out with each expert to identify and describe impacts, compare opinions and resolve

Table 1

Selected experts consulted to develop the Tourism Impact Assessment on the protected areas of Uruguay. The specialists name, profession and relation to the area are given. LRPL: Laguna de Rocha Protected Landscape; QCPL: Quebrada de los Cuervos Protected Landscape; CPNP: Cabo Polonio National Park; SNASPE (in Spanish): National System of Wild Protected Areas of the State of Chile; SNAP (in Spanish): National System of Protected Areas of Uruguay.

Phase	Specialist	Profession	Relation to the area
1	Melissa Gutiérrez	Regional expert	SNASPE – Chile
	Oscar Blumetto	President of local NGO	Vida Silvestre – Uruguay
2	Mariana Ríos	SNAP technician	SNAP
	Javier Vitancurt	PhD. Vet. Med.	Director of LRPL
	Lorena Rodríguez	PhD. in Bio. Sci.	Planning work and research LRPL
	Daniel Erman	Professor – Ranger	Director QCPL
	Ignacio Berro	Professor	Ranger and guide in QCPL
	Mariana Nin	Master in Env. Sci.	Planning work in CPNP
	Mariana Pérez	Ranger	Ranger with wide experience CPNP

discordance among peers (Fig. 1). The final version of the TIA consisted of a consensus matrix that contained all impacts and their descriptions.

### 3.7. Phase 2

To evaluate the magnitude of each impact (step 4), a second group of experts was consulted. Members of this group had to be local experts with broad knowledge of the ecological components, visitor frequency, planning and/or tourism management of each area (Table 1). We performed the consultation via personal interviews with each expert separately. During the interview, each expert expressed their opinion concerning the reality of the area and marked with an “X” the category of magnitude they considered corresponded to each of the impacts. In addition, they were required to identify which touristic activity was associated with each impact and were encouraged to make other pertinent observations. As in the first phase, two rounds were carried out which each expert to compare opinions and resolve discordances among peers. The final result of the TIA was the identification of the impacts associated with each ecological component and its magnitude.

### 3.8. Cases of study

The National System of Protected Areas of Uruguay (SNAP, in Spanish) is part of the Ministry of Housing, Land Planning and Environment (MVOTMA, in Spanish), within the National Direction of Environment (DINAMA, in Spanish). The SNAP department administers fourteen legally-designated protected areas and other areas in the process of incorporation. Tourism in such areas is a new activity that, in recent years, has shown continual growth. Nonetheless, the competent institutions (Ministry of Tourism – MINTUR and SNAP) do not have the necessary information to evaluate whether these activities have any impact on the physical and biotic components of the areas (MINTUR & SNAP pers. comm., 2015).

For validating the TIA, we selected three protected areas from this system, in an effort to conform a heterogeneous sample of areas where tourism is an important activity and/or where it may be considered as a possible threat (Fig. 2). Finally, a decisive criterion was the availability of information on the areas, which was associated with the presence of Management Plans, either approved or in the process of approval. Thus, the sample of protected areas covered the different types of tourism carried out inside the SNAP in the different regions of Uruguay. We selected the following areas:

Laguna de Rocha Protected Landscape (LRPL), located in the Department of Rocha, in the southeast of the Uruguayan territory, covers 22,000 ha (Fig. 2). This area is part of a system of coastal lagoons that connects with the Atlantic Ocean through the temporal aperture of a sand bar. The environmental gradient associated with the fresh-marine waters ecotone generate suitable habitats for birds, both residents and migratory, as well as for fish, mollusks and crustaceans (SNAP, 2016). The landscape is dominated by small hills, high and low plains, and many small body waters (streams, small lagoons) which flood seasonally. The coastal zone also includes fields of dunes and sandy beaches. The wetlands of this area have been internationally recognized, being part of a Biosphere Reserve (UNESCO) and a Ramsar site. Two plant species and 47 animal species of the area are included in the list of priority species of Uruguay and/or have been classified as threatened species (SNAP, 2016). The main pressures and threats affecting the area are the use of agrochemicals, fisheries, ecosystem degradation, habitat substitution, vehicular transit, urbanization and tourism development (Nin et al., 2016; SNAP, 2016). An artisanal fishing community (fish and crustaceans resources) sits within the area. Traditional cattle raising occurs in the territories surrounding the lagoon. The principal touristic activities are horse riding, aquatic sports (Kite Surf, windsurf, etc.), sun and beach tourism, bird watching, guided visits, sport fishing, camping and access to wetlands in canoe or kayak (Caymaris pers. comm, 2015; Futuro Sustentable, 2011; Futuro



Fig. 2. Location of protected areas used as case studies.

Sustentable, 2013).

*Quebrada de los Cuervos Protected Landscape (QCPL)*, located in the Department of Treinta y Tres, in the center-east of Uruguay, covers 4413 ha (Fig. 2). The landscape is characterized by the presence of highlands, a mountain range and ridge ravines connected with the Yerbál River. In addition to the high landscape value, the area is recognized for its diversity, which is promoted by the high humidity. The area has nine clearly distinct environmental units, including riparian and ravine forests, the river system (lagoons and water courses), the sparse shrub land, the prairies and the rocky outcrops (SNAP, 2010). The major part of the area is used for practicing extensive cattle raising but the resident population is minimal (SNAP, 2014). Guided and self-guided hiking, rural tourism, photography, horse riding, lodging and food services, and camping and nature contemplation activities are carried out in the PPCQ (Erman, pers. com., 2015; SNAP, 2014).

Cabo Polonio National Park (CPNP), located in the Atlantic coast of the Department of Rocha in the south-east of Uruguay, covers 25,820 ha including marine (21,151 ha) and terrestrial (4653 ha) zones (Fig. 2). The area is part of the Bañados del Este Biosphere Reserve and its maritime zone is defined as an eco-region of priority for conservation in Latin America (Sprechmann y Capandeguy, 2012). The area conserves one of the few coastal relicts of Uruguay, representative of the coastal ecosystem before colonization and modern urbanization. The best representation in the national territory of transverse mobile dunes, flooded coastal depressions, inter-dune flooded depressions bathed in peat bog and oceanic isles are found in this area (Sprechmann y Capandeguy, 2012). The area contains a town of 70 habitants, who settled there in the XIX century during the commercial exploitation of sea lions. Due to summer tourism, the area receives an important number of seasonal residents and visitors. Admission to the area in all-terrain vehicles, horse riding, gastronomy services, accommodation, visitor information, crafts selling and sun and beach tourism are carried out in the CPNP (Project 2009; (Picasso, 2015; Sprechmann y Capandeguy, 2012)).



**Table 2**  
Description of the identified touristic activities on the three protected areas.

Touristic activity	Description
Hiking and visits	Hiking by traditional or not traditional paths. It requires a certain degree of physical effort and generally, it does not exceed a day of duration. It is realized with or without the accompany of a guide.
Boat trips	Recreational navigation in sea, lakes or rivers, in big boats with combustion motors or sail-propelled, or propelled by human action through rows.
Horse riding	Recreational activity using horses to access wild zones by creating paths or using identified routes. It can last from few hours to various days in combination with refugees or camping.
Sport fishing	Recreational capture of aquatic species with no profit-seeking and by means of properly authorized methods that reduced the impact on fauna populations.
Mountain biking	Riding bicycles off-road, often over rough terrain, using specially designed mountain bikes.
Aquatic non motorized sports	Aquatic sports using light equipment (boards, kites, sails, etc.) that can have a sport or recreational character (kite surf, windsurf, surf).
Sun and beach tourism	Using beach zones with recreational ends, doing activities as sunbathing, sporting activities, hiking and/or bathing. This kind of tourism is accompanied by hotels, services and infrastructure.
Rallying	Motorsport that takes place on highways or roads with specially built cars.
Paragliding	Recreational and competitive sport that consist in the use of paragliders to make long flights.
Rappel	Controlled descent of a vertical or semi-vertical natural drop using a rope.
Spelunking	Recreational exploration of cave systems.
All terrain vehicles (4 × 4)	Recreational movement with traction vehicles in routes presenting natural obstacles such as rivers, hills, gullies, beaches, mud or high slopes.
Fauna watching	Watching fauna species in their natural habitat. It can be done from a watching spot or directly in their habitat. It is done with or without the company of a guide.
Camping	Outdoor recreational activity involving overnight stays on a portable shelter. Specific places for this activity can be created.
Infrastructure/services/urbanization	They can be built for permanent or temporal occupation. It is not a touristic activity per se, but it is a direct consequence of the tourist growth in the area.

**4. Results**

TIA allowed us to evaluate the environmental impact that touristic activities generate in Natural Protected Areas. We identified fifteen touristic activities carried out in the areas within SNAP, among which the seven most common were: hiking, horse riding, fauna watching, aquatic rides, sun and beach tourism, camping, and buildings and urbanization. The remaining activities occurred only in some areas because they depended on the specific characteristics of certain areas and/or because they have not developed due to other reasons (Table 2).

We identified 21 types of impacts on the four components caused by fifteen activities (Table 3). Buildings and urbanization were considered in the identification of touristic activities, since they are tightly linked

to the development of tourism in a given region, even though they may not be considered as touristic activities per se. Thus, buildings and urbanization were considered pressures to which all areas are exposed. Out of the fifteen analyzed activities, paragliding was detected as the only one that does not generate substantial impacts on any ecological component. In contrast, buildings and urbanization impacted in each one of the components. Furthermore, these activities generate the greatest impact on the areas. Out of the four components studied, plant and animal species turned out to be the component receiving the highest number of impacts by touristic activities (14), followed by water (10) and, finally, plant coverage and soil (8) (Table 3).

Differences were found in terms of the magnitude of the impacts among areas (Table 4). In the LRPL, 17 impacts were identified, but

**Table 3**  
Impacts associated to touristic activities on each component of the protected areas.

Activities	Component			
	Biotic		Physical	
	Biodiversity	Plant coverage	Soil	Water
Hiking and visits	Perturbation (P)	Loss (DR) Contamination (SW)	Compaction Erosion	Pollution (SW) Eutrophication (ER)
Boat trips	Perturbation (MV)	Loss (DR) Contamination (SW)	–	Pollution (motors, SW and effluents)
Horse riding	Perturbation by horses	Loss (DR)	Compaction Erosion	Pollution (SW) Eutrophication (animal waste)
Sport fishing	Direct extraction	–	–	Pollution (motors and SW)
Mountain biking	Perturbation (P)	Loss (DR)	Compaction Erosion	Pollution (SW) Eutrophication (ER)
Aquatic non motorized sports	Perturbation (P)	–	–	–
Sun and beach tourism	Direct extraction (P)	Loss (DR) Contamination (SW)	Compaction Erosion	Pollution (SW)
Rallying	Perturbation (MV)	–	Compaction Erosion	Pollution (motors)
Paragliding	–	–	–	–
Rappel	Perturbation (P)	–	–	–
Spelunking	Perturbation (P)	–	–	–
All terrain vehicles	Perturbation (MV)	Loss (DR)	Compaction Erosion	Pollution (motors and SW) Eutrophication (ER)
Fauna watching	Perturbation (P)	–	–	–
Camping	Habitat reduction Perturbation (P and MV)	Loss (DR)	Compaction Erosion	Pollution (RS and liquids) Eutrophication (ER)
Infrastructure / services / urbanization	Habitat reduction Perturbation (P and MV)	Loss (DR)	Effluent pollution and erosion	Pollution (SW and effluents) Non sustainable consumption

P: People; MV: motorized vehicles; DR: damage or removal; SW: solid wastes; ER: erosion and runoffs.

**Table 4**  
Main results of TIA performed on the three study areas. LRPL: Laguna de Rocha Protected Landscape; QCPL: Quebrada de los Cuervos Protected Landscape; CPNP: Cabo Polonio National Park.

Component	Impact	Magnitude		
		Protected area		
		LRPL	QCPL	CPNP
Biodiversity	Perturbation by people	High	Medium	Low
	Perturbation by horses	Low	Low	Low
	Perturbation by motorized vehicles	Medium	Low	High
	Direct extraction of individuals	Low	Low	Medium
	Reduction of flora and fauna habitats	Low	Low	Medium
Plant coverage	Partial loss by damage or removal	Low	Low	High
	Total loss by damage or removal	Zero	Zero	Zero
	Pollution by solid wastes	Medium	Medium	Low
Soil	Erosion by human treading	Low	Medium	High
	Erosion by horse treading	Zero	Zero	Low
	Erosion by wheels	Medium	Zero	High
	Erosion by waves	Zero	Zero	Zero
	Erosion by camping sites	Low	Low	Zero
	Erosion by urbanization	Low	Zero	High
	Compaction	Low	Low	High
Water	Pollution by effluents	Low	High	High
	Pollution by solid wastes	Medium	Low	Low
	Pollution by motors	Medium	Zero	Medium
	Pollution by effluents	Medium	High	High
	Eutrophication	Medium	Zero	Medium
	Non sustainable consumption	Zero	Medium	High
	No impact (%)	19	33	14
	Low impact (%)	43	38	24
	Medium impact (%)	33	19	19
	High impacts (%)	5	10	43

only one had high magnitude (perturbation to animal and plant populations by people) and four were considered nonexistent. In the QCPL, 14 impacts were identified, two of them with high magnitude (pollution by effluents in soil and pollution by effluents in water) and seven nonexistent. In the CPNP, 18 impacts were identified, nine of them with a high magnitude (partial loss of plant cover by damage or removal, erosion by human treading, soil compaction, non-sustainable consumption of water, biodiversity perturbation by motorized vehicles, erosion by wheels, erosion by urbanization and soil and water pollution by effluents) and three of them were considered nonexistent (Table 4). In general, considering all activities performed in the three NPA, 22% had no detectable impacts, 35% had a low impact, 24% had a medium impact and 19% had a high impact on the four components.

### 5. Discussion

TIA provided key information for the three protected areas analyzed in this study. Our results showed that environmental impacts are mainly associated with spontaneous activities. This implies that there is no supervision or regulation of visitor quantity, nor of the kind of activities they develop in the areas. This suggests that the objectives of promoting planned tourism and respecting the receiving capacity established for the protected areas of Uruguay may not be entirely achieved (i.e. self-guided visits, beach and sun tourism and camping). However, 57% of the total identified impacts were null or of low magnitude. This was mainly because of the “frequency of pressure” criteria. In Uruguay, tourism in protected areas may be considered low and episodic, in contrast with other countries, like Mexico, where tourism is an important and constant activity in the protected areas (Segrado et al., 2015). However, tourism in protected areas is expanding worldwide, so an increase can be expected in forthcoming

years in Uruguay and having plans to organize tourist activity will help both the tourism activity itself and the conservation of the area.

Generally, central governments are responsible for evaluating and managing tourism impacts on protected areas. However, impact evaluations based on TIA can be applied by local governments, non-governmental organizations and/or local habitants of the area. This is an advantage over the LAC methodology, since even if they have the same theoretical bases, LACs entail a complex participative process driven by an expert and a consensus around the desired standards from all the stakeholders. Thus, TIA can be used continuously as part of monitoring programs and can also favor negotiation between different points of view and facilitate the integrative management of the area. Moreover, TIA does not imply large costs for its application.

TIA can be applied to estimate the environmental impact of different productive, social or cultural activities preformed in protected areas. To do this, impacts should be identified properly and the criteria to estimate the impact magnitude should be adapted following the proposed methodology. In order to successfully apply TIA, its application requires the inclusion of persons from different sectors and disciplines. This is necessary to avoid bias in the results, since, as previously mentioned, the results of TIA depend on the perception of the persons that apply it.

In addition, there are two possible spatial scales for the application of TIA. On the one hand, it is possible to consider the whole protected area and assess overall the impacts magnitude. On the other hand, the tool could be applied locally within the area, assessing the magnitude of impacts in specific zones where the tourism activities are developed. Thus, it can be possible to differentiate between the activities having a high local impact, but that in regional scale only represent a low percentage of the total area (e.g., high magnitude of erosion by human treading in the CPNP). In this sense, we recommend applying TIA at both a local and regional scale simultaneously to have a complete record of the situation. Nonetheless, depending on the objectives of its application, it is possible to apply TIA only at a certain scale, during which the identification of impacts must be defined as corresponding to a local or regional impact.

TIA could be adapted following the methodological steps proposed here to plan future activities that have potential environmental impacts. Thus, TIA can be aligned with conservation goals to evaluate the pertinence of stimulating touristic activities in protected areas. In this vein, the TIA results could be useful inputs to zoning public use in protected areas, with the aim of minimizing future environmental impacts.

Protected areas in which tourism is planned or developed should have detailed tourist zoning, which must be completely compatible with the overall zonation of the area (Báez & Acuña, 2003; Boschi & Torre, 2005). By doing this, it may be possible to control the growth of touristic activities and to prevent the increasing magnitude of impacts. In order to improve tourism management, desired standards must be established on the conditions of ecological components to monitor negative impacts of tourism on these in the medium and long term. Regarding management, it is important to consider the quantity and quality of change willing to be accepted in the components of each protected area, as touristic activities are only one of many factors that can affect these components. Special consideration should be made for activities that were developed before the protected area was decreed.

Some South American countries as Argentina, Chile and Colombia have policies and/or specific strategies for ecotourism in protected areas or reserves (Alicia, 2008; CONAF, 2000; CONAF, 2015; Lazo et al., 2014; MinAmbiente – Ministerio de Ambiente y Desarrollo Sostenible – Parques Nacionales Naturales de Colombia, 2013). These strategies aim to organize touristic activities to manage, prevent and mitigate their negative impacts. For example, National Parks in Colombia are classified into two categories according to their ecotourism vocation: (1) tourism is promoted without major assessment, and (2) it is necessary to assess the effects of tourist activities on the conservation goals of the area (MinAmbiente – Ministerio de Ambiente y Desarrollo

Sostenible – Parques Nacionales Naturales de Colombia, 2013). In this vein, TIA could be applied in both categories, as a tool for monitoring across time the changes in magnitude of the impacts generated by touristic activities.

## 6. Conclusion

Tourism in Natural Protected Areas is growing. In order to ensure that ecotourism contributes to the conservation of these areas, tourism activities and their environmental impact need to be properly assessed and managed. Tourism Impact Assessment is a flexible and practical tool that can be easily used to assess and monitor environmental impacts caused by touristic activities in order to guide tourism management and avoid irreversible deterioration. The application of this method could lead to better tourism planning and management, which ultimately seeks to conserve the components and functions of Natural Protected Areas.

The main advantages of TIA over other methodologies such as the LAC methodology are that TIA can be applied by a diversity of stakeholders without the need of a technical knowledge and it does not imply large cost for its application. The main limitation of TIA is that its application and results could be biased by the point of view of the person that conducts TIA. In order to solve this problem, the training of this people and the inclusion of persons from different sectors and disciplines are recommended. Despite that this could generate extra costs in terms of time or money, it could increase the validity of TIA results.

For future research, to apply TIA in other systems of protected areas could allow to test the flexibility of the tool and to generate lessons to adjust TIA in order to make a more robust and useful tool. For instance, the application of the tool at different levels (on the whole area or only a particular zone) could be useful in order to generate lessons and criteria to define the geographic scale for the application of TIA according to the characteristics of the protected area and the touristic activities develop in this area.

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