Recommendation for Attention Towards an Indicator Species List for the Aripo Savannas Environmentally Sensitive Area, Trinidad

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Aripo Savannas photograph from the Fishermen and Friends of the Sea, Trinidad and Tobago. https://ffostt.com/2020/03/20/aripo-savannas-strict-nature-reserve/.

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Summary: In the interest of conservation, it is advisable for the National Trust of Trinidad and Tobago to devote resources to begin the creation of a list of indicator species (IS) within the Aripo Savannas Environmentally Sensitive Area (ASESA). Such an effort was recently undertaken for other areas in the country as part of a United Nations project (IFPAMTT), and the proposed National Trust actions should necessarily require less funding than this large-scale, international endeavor. However, this past project provides context for the importance of identifying IS, and related documents suggest broad methods by which the effort may be completed. Research was conducted into which specific plant and animal species could be included in a prototype list of indicator species for the ASESA based on their characteristics and presence in the scientific literature and government documents. This preliminary list, which is not intended to be final, could be used as a tool for the National Trust in the process of stakeholder identification and analysis (SIA). Research was also conducted to clarify information about how SIA functions and what costs it may require.

Recommendations:

- **Gauge whether beginning the creation of an indicator species list for the ASESA is indeed of interest to the goals of the National Trust.**
- **Commence the process by conducting stakeholder identification and analysis for those groups and individuals who have knowledge of the area and could assist with creating refined lists of species.**
- **Consider the prospect of continuing in the general method of the IFPAMTT by contacting an organization which could survey the area; otherwise, consider lower-cost approaches such as the BioBlitz.**

Introduction:

To serve the project known as Improving Forest and Protected Area Management in Trinidad and Tobago (IFPAMTT), one of the actions of the Food and Agriculture Organization of the United Nations (FAO) was to prepare management plans for six areas planned to be designated as protected areas in Trinidad and Tobago. The IFPAMTT, whose objectives also included the creation of a National Protected Areas System Plan and a Sustainable Financing System, lasted from 2015-2020 and required a total of over $30 million USD (The Government of the Republic of Trinidad and Tobago, 2022). Though five of the six areas included in the IFPAMTT (Caroni Swamp, Main Ridge Forest Reserve, Matura Forest, Nariva Swamp, and Trinity Hills) are reported alongside Aripo Savannas in an existing group of protected areas for Trinidad and Tobago in Spiers et al. (2018), Aripo Savannas was not one of the six areas focused upon in the project (The Government of the Republic of Trinidad and Tobago, 2022).

Indicator species (IS), a term used to refer to species whose characteristics and dynamics have been used to explain environmental processes and changes (Siddig et al., 2016; Landres et al., 1988), were an important element of the IFPAMTT. A preliminary UN document concerning Northeast Tobago stresses that determination of IS should involve many stakeholders, including local groups who have experience with species (Wothke et al., 2013). Stakeholders eventually produced a list of 99 species after being contacted by those working on the project, and this list was refined and expanded through surveying and analysis by scientists at the University of the West Indies (UWI; Marley, 2018). Species included invertebrates, mammals, and plants, among other groups (FAO, 2019a). Sets of stakeholders, which differed based on the protected area (see Table 1 in the Appendix), included government bodies such as the Environmental Management Authority, the Ministry of Tourism, the Forestry Divison (FAO, 2019a; FAO, 2019d), and the Department of the Environment (2019d) as well as citizen groups including the Trinidad and Tobago Field Naturalists' Club (FAO, 2019a; FAO, 2019d), Environment Tobago, and tourists more generally (FAO, 2019d). The National Trust itself is listed as a stakeholder in several documents (FAO, 2019b; FAO, 2019e). The Caribbean Natural Resources Institute (CANARI) determined stakeholders for the IFPAMTT protected areas in a process known as stakeholder identification and analysis (hereafter SIA; FAO, 2019d). Several plans include information about costs and time associated with future efforts relating to SIA separate from CANARI, though information differs in each source (Table 1).

IFPAMTT documents identify several different characteristics which are used to gauge whether a species should be classified as an IS. FAO (2019b) cites Siddig et al. (2016), who conduct an extensive literature review and find that scientists writing for the journal *Ecological Indicators* have determined species to be IS based on whether the species was adequately classified as an IS in previous studies, its abundance, and/or its "ecological importance or conservation status". Further, FAO (2019a) includes that IS show "predictable responses" to human impact on ecosystems. FAO (2019c) adds that high importance to the economy and/or a conservation status close to extinction are also elements of IS qualification. The latter characteristic is reflected by Wothke et al. (2013), who draw from the International Union for Conservation of Nature Red List of Threatened Species (hereafter IUCN Red List) in their development a list of five IS for Northeast Tobago. To these authors, whose work represents an early stage in the IFPAMTT, conservation importance and IUCN Red List classification appear related. Wothke et al. (2013) also consider how each species is intended to be monitored in the future. In a similar manner, UWI researchers who had received the stakeholder-produced list removed those species which they believed could not be surveyed. Experts also delisted many species which were unique to only one of the six areas, therein implying a concern for efficiency (University of the West Indies, n.d.).

IFPAMTT documents establish IS as meaningful for the project; their identification is termed a "key requisite" for conservation (Marley, 2018), and such species are said to represent large sections of "conservation targets" in one final document (FAO, 2019b). Given this established importance for a project based on protected areas in Trinidad and Tobago, working towards an IS list for the Aripo Savannas could meaningfully advance the National Trust's goals of "encouraging research into… animal, plant, or marine life" and "conserving the plant and animal life" of Trinidad (National Trust of Trinidad and Tobago, n.d.). For the purposes of this report, it was naturally determined that an effort matching the scope and funding of the IFPAMTT would not be feasible for recommendation. Though data from the management plans are inconsistent and a general cost for SIA could not be identified within said documents, future estimates for applications of the process appear to be considered less-expensive actions compared to the multi-million dollar cost of the entire IFPAMTT (Table 1). This observation is continuous with the fact that the project encompassed many more objectives than IS lists, including the development of policy and lasting management plans (The Government of Trinidad

and Tobago, 2022). Particular focus may be placed on the Main Ridge Forest Reserve plan, whose authors list stakeholder identification and analysis in one future strategy guide as a no-cost operation for stakeholders yet also include it in another section as an item expected to cost a total of $18,000 USD (Table 1; FAO, 2019b). The purpose of this report is to recommend the beginning of the development of an IS list; since the IFPAMTT involved a stakeholder-derived IS list, it is amenable to begin the process of establishing an IS list for the ASESA with identifying those groups which could combine their knowledge and experience for the benefit of the list (Marley, 2018; Wothke et al., 2013).

Given this information, conducting a form of SIA would be a primary step to the creation of an ASESA IS list. This action could strengthen the ties between the National Trust and organizations and community members who have experience with the plant and animal life of the Aripo Savannas. If it is determined that funds directly from the National Trust would not be used on this project, there exists the possibility of contacting a graduate student who would work to complete the stakeholder identification as part of a thesis with grant funding; this topic will be expanded upon later in the report (Dr. Alexis Mychajliw, personal communication, 27 March 2022). Notwithstanding, it is recommended that the National Trust facilitate creation of an IS list for the Aripo Savannas, in view of the establishment of IS lists for other protected areas in Trinidad and Tobago and the importance placed upon IS in the IFPAMTT.

In order to advance the process, scientific literature will be surveyed and any species which match one or more IS characteristics established by the aforementioned sources – FAO (2019a-c), Siddig et al. (2016), Wothke et al., (2013) – will be collected together. This rough species group is not intended to be a final product, for it is abundantly clear that such an endeavor would not be possible without the expertise and knowledge of individuals and organizations close in proximity to the ASESA. In addition, documents and scientific literature outside of the IFPAMTT containing information about SIA will also be located to assist the National Trust in its consideration of the values of pursuing such a method.

Methods:

In determining the aforementioned preliminary IS list, the database Scopus (scopus.com) was surveyed using the search “Aripo Savannas”. Google Scholar (scholar.google.com) was also searched using the same query. Any sources which were identified as containing information

about plant and/or animal species within the ASESA were analyzed in order to determine whether any discussed species could be reasonably considered an IS for the area, given the aforementioned requirements established in FAO (2019a-c), Siddig et al. (2016), and Wothke et al. (2013). A set of eleven documents provided by the Environmental Management Authority, containing articles from the literature and government reports, were also analyzed. Said documents exclusively concern the ASESA and were delivered through personal communication on 17 March 2022. The EMA has been involved with the ASESA for at least two decades (Young, 2006), and it was determined that the resources the organization could provide were well worth analysis. On Google Scholar, attention was preferentially placed on sources from journals. If the title or abstract of a source did not appear to specifically pertain to the ASESA, other sources were instead pursued; Beard (1953) is an exception to this rule.

For the characteristic of abundance, included in Siddig et al. (2016) and cited in FAO (2019b), species which were written about as being abundant within the ASESA were included. An attempt was made to avoid including species which were only written about as being relatively abundant within their own species group. In the case of Beard (1953), the term "principal" was interpreted to be a synonym of abundance. If surveying a particular species was related to assessing human impact within the ASESA, that species was also included under the aforementioned language in FAO (2019a). Owing to the fact that conservation status of a species is implicated in IS identification in FAO (2019c) and Wothke et al. (2013), the current IUCN Red List status (as of 10 April 2022) was also searched for each species included in the draft list. Species which were referred to in writing as threatened on the IUCN Red List were also listed for this reason. Although it was not expected that a list of IS for the area would already exist, any species which were identified as IS for the ASESA in the literature were added following an interpretation of Siddig et al. (2016). It was decided that high economic relevance, referred to in FAO (2019c), was not a characteristic for which specific attention should be given due to the scope of the report. Last, the identification of an entire genus as being abundant, as in Beard (1953), was passed by due to the IS lists in the IFPAMTT final management plans (FAO, 2019a-e) appearing to only include species.

The idea of an examination of SIA was also considered valuable, with the aim of elucidating information on the process of the practice and its cost. It was decided that attention should be given to the work of Renard (2004); this is a report from CANARI, the organization

which was responsible for the IFPAMTT SIA process (FAO, 2019d), on how an organization may complete it. Any further information on the cost of SIA for past projects was also pursued by searching for the term “cost of "stakeholder identification and analysis" and "protected area"” on Google Scholar (scholar.google.com), given that the similar search “"stakeholder identification and analysis" and "protected area"” produced no results on Scopus (scopus.com). For brevity, the term “cost” was searched within each source in order to determine whether the source pertained to the cost of SIA itself. In some cases, a variation of “stakeholder identification and analysis”, such as “stakeholder identification” or “stakeholder analysis”, was also searched in order to locate relevant sections. Books (n=9) were excluded from the analysis due to the scope of the report and a preference for the scientific literature on the topic.

Results:

Possible indicator species for the ASESA

There is a body of literature and documentation about the vegetation and animal life within different areas of the Aripo Savannas. The search parameter produced seven results in Scopus and 154 results in Google Scholar. Species which were determined to match one or more characteristics for an IS are delineated below and included in Table 2, with a graphical representation in Figure 1 (see Appendix for both; see the Methods section for characteristics). Across the available literature, including Environmental Management Authority documents (see the Methods section), a total of twenty-four species were collected. Broad species groups were determined in order to produce Figure 1 and are also included in Table 2. More flora than fauna were judged to be possible indicator species based on the literature review. The majority of fauna included in Table 2 and Figure 1 were found in Auguste and Hailey (2018), while flora were not as concentrated in a single source. Of all characteristics, that a species was abundant within an area of the ASESA (FAO, 2019b; Siddig et al., 2016) was the most often found. Six species, all fauna, were referred to with language expressing their importance to conservation or conservation status. However, no species in Table 2 or Figure 1 was found to have a status more serious than Least Concern in the IUCN Red List, and many species were not listed on the website as of 10 April 2022. Sources will be described below in order to provide context for their inclusion in Table 2 and Figure 1.

Six species of trees were found to match one or more IS characteristics in the aforementioned sources. Federman et al. (2014) propose that the intrusion of the built environment and hunting into the savannas have resulted in a reduction of the ability of some species to diffuse seeds of the Moriche palm (*Mauritia flexuosa*) far away from individual plants, indicating that characteristics of this species may have an application for gauging the impact of development on the ASESA (FAO, 2019a). The authors also state that *M. flexuosa* is an abundant plant species in the ASESA, an observation shared by Comeau (1989), therein fulfilling one of the historical characteristics of IS noted by Siddig et al. (2016). van der Hoek et al. (2019), a source not included as part of the literature review but which is related to *M. flexuosa* as a species, also argue that the Moriche palm is a keystone species for neotropical savanna ecosystems. The remaining five tree species (*Symphonia globulifera* [boarwood; IUCN, 2019], *Clusia nemorosa*, *Clusia palmicida*, *Chrysobalanus icaco* [cocoplum; Brown and Frank, 2018], and *Ilex arimensis* [biscuitwood; Comeau and Clubbe, 1998] are indicated by Beard (1953) to be "principal" species which form the forested sections of the ASESA, and it was determined that this description could merit the characteristic of abundance described in Siddig et al. (2016). *I. arimensis* is also stated to be an IS for environmental change in Comeau and Clubbe (1998) and was thus primarily included for this reason.

Many other species of flora are listed in Table 2 and Figure 1, including two species of grasses described as prevalent. Richardson (1963) delcares the grass *Paspalum pulchellum* Kunth as the most critical and abundant plant in the savanna areas of the ASESA in an analysis of the vegetation, and Schwab (1988) lists *Panicum stenodes*. The former species is also referred to as an IS in Comeau and Clubbe (1998). Richardson (1963) additionally names *Chrysobalanus icaco* var. *pellocarpus* and *Byrsonima crassifolia* as two particularly common species of shrub. (The former species is listed as a tree in Beard (1953) yet is referred to as a shrub in this source.) *Miconia ciliata*, another shrub (Ministry of Agriculture, Lands and Food Production, 1982), is included in a small list of abundant, relatively large open savanna species in Quesnel (1979).

Three species of sedge (*Rhynchospora podosperma*, *Rhynchospora curvula*, and *Rhynchospora barbata*) are included as select abundant savanna species in the vegetation analysis of Schwab (1988), and the last of these species is another which Comeau and Clubbe (1998) state to be a form of IS; said authors also include *Lagenocarpus rigidus* in the same category. Last of the sedges in Table 2 and Figure 1 is *Lagenocarpus guianensus* Nees., stated to

be “the dominant sedge” by Beard (1953). Other flora include the herb *Drosera capillaris* (pink sundew; University of Florida Center for Aquatic and Invasive Plants, 2022), which is included in Schwab (1988), and *Isertia parviflora* (wild ixora), the final plant species referred to by Comeau and Clubbe (1998) as an IS for the ASESA.

Seven species of fauna – five amphibians, one bird, and one mammal – were also determined to have one or more IS characteristics. In their study of amphibians in the ASESA, Auguste and Hailey (2018) describe a genetically-related group of five amphibian species which they believe could be particularly sensitive to changes in the environment, potentially matching with the historically-used conservation-related IS characteristic set out in Siddig et al. (2016). These species consist of *Leptodactylus fuscus* (whistling frog; Questelles, 2016), *Pristimantis urichi* (Urich’s robber frog; Lehtinen, 2018), *Scinax ruber* (brown tree frog; Bahall, 2017), *Flectonotus fitzgeraldi* (dwarf marsupial frog; Tobias, 2015), and *Dendropsophus goughi*. Two of these species, *P. urichi* and *F. fitzgeraldi*, are stated to be endangered on the IUCN Red List by Auguste et al. (2015), Ministry of Works and Transport (2017), and Auguste and Hailey (2018), yet both are listed as LC (Least Concern) on the website as of 12 April 2022 (Downie et al, 2020; La Marca et al., 2020). Both of these species were included in the table for the general conservation reason addressed in Auguste et al. (2018), and IUCN Red List classification is still listed alongside these species in order to appropriately represent the history of the species in the literature. The description of *Orthopsittaca manilata* (red-bellied macaw) in Hosein et al. (2017) as having a “high abundance” was assessed to fulfill the respective characteristic from Siddig et al. (2016); since similar language was not located for the other bird species in the study, *Amazona amazonica* (orange-winged parrot), it was not included. Last, an environmental impact assessement which addresses parts of the ASESA by National Infrastructure Development Company Limited (2017) identifies *Felis pardalis* (ocelot) as a species which should be held as important to conservation even though it is listed as Least Concern in the IUCN Red List; per the source, it is an Environmentally Sensitive Species in the country.

Stakeholder identification and analysis

Renard (2004) represents a publication from an organization related to the IFPAMTT (CANARI) whose purpose is to explain SIA to Caribbean organizations, and it was thus chosen for scrutiny. The full report should be consulted for specific language, which will not be copied to this document. The source is useful for this report in its delineation of the individual steps of

SIA and the establishment of the difference between the terms stakeholder identification and stakeholder analysis. For the former, referred to as a comprehensive listing of all parties to be involved in the project, the author stresses that an approach in which the "functions" of different physical attributes of the area in question are used to generate associated stakeholders will result a more directed and effective identification process (Renaud, 2004). In its focus on maintaining full participation, the report also argues the benefits of allowing defined stakeholders to identify other groups with which they are familiar and which may also have a place in the process. For stakeholder analysis, Renaud emphasizes the importance of tailoring the process to the specific problem that the lead organization wishes to solve so as to maximize efficiency. In addition, the report includes examples of added analysis dimensions, such as conflict, which have reportedly proved integral to Caribbean case studies (Renaud, 2004).

A limited amount of general information concerning the costs associated with conducting SIA was gleaned from the cursory literature review, whose search parameter (see the Methods section) yielded 100 results. No sources surveyed were found to include specific amounts for cost, but several sources appear to imply that aspects of SIA can result in high costs. Sovacool (2008) lists cost as a disadvantage of the method as a whole, while Weible (2007) indicates that a particular approach to the method can be "relatively costly" due to the volume of interviews involved. Similarly, Reed et al. (2009) list interviews as an analytical approach which requires more funding than others, and McConney et al. (2009) state that increasing "participat[ion]" results in "considerable" costs. While also suggesting that interviews incur costs, Soeftestad (2011) designs a simpler analysis without this element and concludes that avoiding the associated expenses did not remove the value of the exercise. Distinct and last among the sources is another publication by CANARI which insinuates that SIA eschews the high expenditures incurred by other approaches to gathering information about an area and its resources (Renard, 2001).

Discussion

Table 2 and Figure 1 may be seen to underrepresent the fauna of the ASESA; seventeen out of twenty-four species is flora, and only one species is listed for both birds and mammals (*Orthopsittaca manilata* and *Felis pardalis*, respectively). The data also have a high share of species which were observed to be referred to as prevalent in the ASESA, with few flora listed due to other characteristics. A particularly compelling finding is the observation that the two

species of amphibians referred to as endangered on the IUCN Red List as recently as 2014 (*Pristimantis urichi* and *Flectonotus fitzgeraldi*; Auguste and Hailey, 2018; Ministry of Works and Transport, 2017; Auguste et al., 2015) are now listed as Least Concern (Downie et al, 2020; La Marca et al., 2020). Since conservation status was implicated in whether species were considered IS in an IFPAMTT document (Wothke et al., 2013), this change may signify the need for frequent surveys and monitoring in order to maintain an updated catalogue of species for use in IS determination, especially considering that the body of literature for the ASESA includes observations dating back more than half a century (Beard, 1953; Richardson, 1963).

As previously stated, this first-pass list is not intended as a final draft, given that no stakeholder identification or analysis was conducted. Stakeholders for the ASESA, including the National Trust, undoubtedly hold a wealth of knowledge about the current state of the area, some of which is likely not represented within the scientific literature and the select documents which comprised the review. As such, it is held as certain that a rigorous determination of IS would not be possible without contacting these groups and individuals. Apart from any potential limitations of the literature review, it is important to note that the lists included in the IFPAMTT final management plans were the result of surveying on-site by the University of the West Indies, meaning that the National Trust would have to engage with an educational institution or other body which is capable of such analysis were it to closely follow the IFPAMTT. These UWI lists concerned the efficiency of surveying particular species, a dimension which was not included in the literature review (Marley, 2018; University of the West Indies, n.d.).

The literature review on SIA did not generate any examples of specific costs for projects, and it can be assumed that such data would be better pursued in a different manner (perhaps by obtaining relevant documents from organizations). Examples of graphical approaches to the process of SIA which were present in the literature were also not gathered due to the scope of the report. It can be assumed that the main issue or problem the National Trust would seek to solve through beginning the SIA process (Renard, 2004) is the clarification of how each stakeholder – categories could include agencies, groups of local people, non-governmental organizations, and educational institutions – could assist in the process of creating an IS list for the ASESA. Given this goal, stakeholder identification could involve those groups who may hold an interest in the conservation of species within the ASESA. During the process, it may also be useful to apply the preliminary IS list in Table 2 in order to ascertain whether any groups may have a specific

connection to one in particular (for example, a species may have local, cultural significance). Stakeholder analysis could deal with the changes which IS designation may bring to the management and use of the ASESA – how would each identified stakeholder be able to advance the creation of an IS list, and/or how could relationships between humans and species change? At first glance, the establishment of an IS list as a basis for SIA appears to be a less complex topic than, for instance, the formation of a protected area, but such a contention is not based on an analysis of data. For the cost of stakeholder analysis, the assertion that an interview-based approach to the process is more costly, as included in Weible (2007), McConney et al. (2007), and Reed et al., (2009), may indicate that the National Trust could lessen this element of analysis if it desired an economical approach to this problem.

Alternative measures

In the case that the National Trust does not deem SIA a suitable use of funding or time, it may instead consider sponsoring a certain type of recently-developed citizen science event known as the bioblitz (van Gunst et al., 2020), often stylized as BioBlitz, for the ASESA. The BioBlitz is a type of data-gathering strategy which National Geographic describes as a fount of potential for collecting "snapshot[s]" of "as many species as possible" for a given area of conservation or general interest (National Geographic, n.d.). In their review of citizen science measures at natural history museums in the United States and United Kingdom, Ballard et al. (2017) characterize examples of BioBlitzes as brief bursts of activity with limited instruction for groups with wide ranges of scientific experience. The method has been used in conjunction with the citizen science smartphone application and website iNaturalist (Rokop et al., 2022; United States National Park Service, 2019; National Geographic, n.d.), allowing for users to upload pictures of species which they find on-site to a global, shared database (iNaturalist, 2022). iNaturalist, owned by the California Academy of Sciences and National Geographic, provides the ability for images to be verified by experts as "research-quality" (Ueda, 2022). National Geographic suggests that a BioBlitz host organization contact other organizations to ensure that the event has sufficient volunteer personnel, and they specifically recommend involving university students who could function as career role models for any children who happen to attend (National Geographic, n.d.). Lundmark (2003) implies that it is also standard for professional scientists to be present. as well. For an ASESA BioBlitz, the University of the West Indies may therefore be an appropriate partner institution. In general, a BioBlitz is suggested due

to its low cost (Lundmark, 2003) and potential to provide groups managing the ASESA with current observations of species.

For a continual impact on data collection, the establishment of a program similar in function to Forest Check, a project of Environmental Research Institute Charlottesville (ERIC), could be considered. Forest Check, which sees non-scientists help identify indicator species within the Main Ridge Forest Reserve, thus represents a citizen science measure which supports the results of the IS lists developed in the IFPAMTT (Environmental Research Institute Charlottesville, n.d.).

Recommendations

First, the National Trust should consider whether its organizational aims coincide with the development of an IS list for the ASESA and any effects which such a measure would bring to management. This determination could include experience- or literature-derived estimates of required time and funding. For the purposes of this report, it is believed that this goal has the potential to increase stakeholder participation in ASESA management and identify future conservation objectives; however, it is of course the choice of the organization whether to pursue the matter. If the eventual creation of an IS list similar to those for other protected areas in the ASESA (FAO, 2019a-e) is indeed desired, the National Trust should begin stakeholder identification and analysis. This process could take advantage of the steps and information provided in Renard (2004). To approximate the process used for the IFPAMTT, the National Trust should then contact stakeholders to ask them about which species they believe qualify as IS in order to build a preliminary list for the area (Marley, 2018). If the process is deemed worthy of continuation, this list would then be delivered to an institution such as the University of the West Indies with personnel able to carry out surveying to refine the stakeholder-based IS list (Marley, 2018; University of the West Indies, n.d.).

If the National Trust does not wish to carry out SIA for this purpose, it should instead consider investigating whether a graduate student at a nearby university could be persuaded to helm SIA as a project (see the below section for more details). Last, while residents living close to the ASESA may become involved in stakeholder analysis, there also exists the options of managing a BioBlitz event wherein people of all scientific backgrounds would be invited to catalog plant and animal species within the ASESA or examining the possibility of a Forest Check-like program for the area (Environmental Research Institute Charlottesville, n.d.).

Funding

IFPAMTT management plans, which detail the expected costs for the administration of the protected areas included in the project, suggest methods by which funding may be obtained for the future (2019-2029). It is assumed that a portion of said avenues are also available to the National Trust in the case that organization should pursue any of the above steps which require funding. In the IFPAMTT documents, grant funding is suggested to be derived from the Green Fund of Trinidad and Tobago (FAO, 2019a-e), the Global Environment Facility Small Grants Programme (FAO, 2019a; FAO, 2019c; FAO, 2019d; FAO, 2019e), The Nature Conservency (FAO, 2019a; FAO, 2019c), the Environmental Management Authority Trust Fund (FAO, 2019c), the Caribbean Biodiversity Fund (FAO, 2019b), and/or the Green Climate Fund (FAO, 2019e). One plan suggests that other funding may be able to be provided by companies located close to the protected area (FAO, 2019a). It is important to note that these sources of funding are not included in the documents to specifically address funding SIA or a BioBlitz; rather, they are listed for other purposes. The inclusion of these organizations in this report is intended to provide a list of those funds which have already been included in the text of a similar project. In this way, it is thought that these sources are likely to be associated with conservation in Trinidad and Tobago.

The University of the West Indies could also be contacted in order to determine whether any masters' students would be interested in constructing a stakeholder identification and analysis for the ASESA as their masters' thesis project (Dr. Alexis Mychajliw, personal communication, 27 March 2022). In this case, the student could apply for a National Geographic Society Level I Grant, covering up to $20,000 USD (National Geographic Society, 2022).

Appendix

Table 1. Information about stakeholders and planned stakeholder identification from the five final management plans produced as part of the IFPAMTT. The cost associated with past stakeholder identification and analysis completed by CANARI is not listed in any plan.

Area	*Total number of stakeholders listed*	*Costs associated with future stakeholder identification*	*Timescale for future stakeholder identification*	*Stakeholder identification leader*
Caroni Swamp Protected Area (FAO, 2019a)	33	Not listed	Not listed	CANARI (2017)
Main Ridge Forest Reserve National Park (FAO, 2019b)	30	$0 or $6000/year for stakeholder identification	3 years for future management strategies	CANARI (2017); North-East Tobago Protected Area Management Trust (future)
Matura Forest and Coastal Zone (FAO, 2019c)	10	Not listed	Not listed	Not listed
Nariva Swamp Protected Area (FAO, 2019d)	36	Not listed	0.5 years	CANARI (2017)
Northeast Tobago Marine Protected Area (FAO, 2019e)	82	$50000 for revising stakeholder identification	1.5 years	CANARI (2017); Departments of Marine Resources and Fisheries and Natural Resources and Forestry (future)

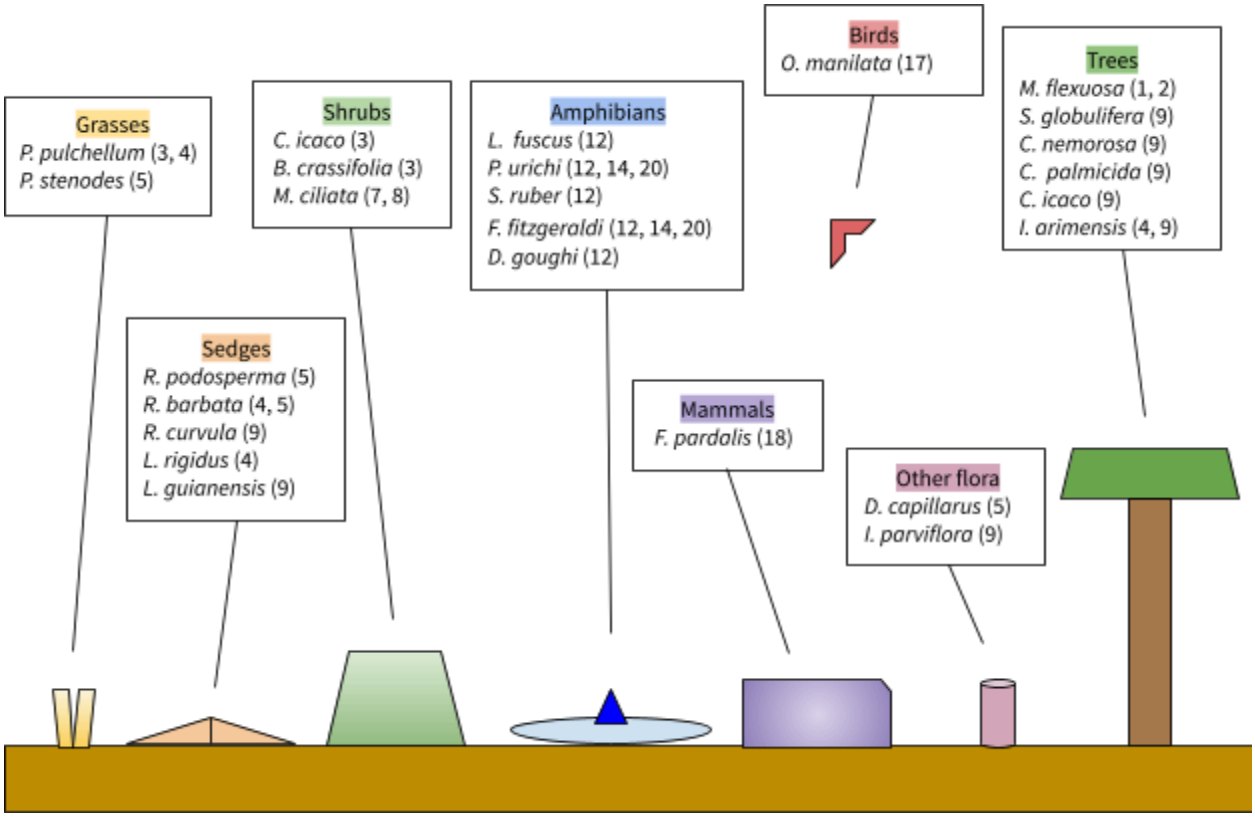

Figure 1. Groupings of species which were found to be referred to with language corresponding to one or more of the characteristics for an IS from FAO (2019a-c), Siddig et al. (2016), and/or Wothke et al. (2013). Please see Table 2 (Appendix) for genus names, common names, specific reasons for inclusion, and IUCN Red List status. Following the caption of Table 2, sources are as follows: (1) refers to Federman et al. (2014), (2) to Comeau (1989), (3) to Richardson (1963), (4) to Comeau and Clubbe (1998), (5) to Schwab (1988), (7) to Ministry of Agriculture, Lands and Food Production (1982), (8) to Quesnel (1979), (9) to Beard (1953), (12) to Auguste and Hailey (2018), (14) to Ministry of Works and Transport (2017), (17) to Hosein et al. (2017), (18) to National Infrastructure Development Company Limited (2017), (20) to Auguste et al. (2015).

Table 2. Collected results of a literature review for flora and fauna within the ASESA. The current IUCN status was assessed by searching each scientific name on the website (iucnredlist.org). LC=Least Concern. Sources are as follows: (1) refers to Federman et al. (2014), (2) to Comeau (1989), (3) to Richardson (1963), (4) to Comeau and Clubbe (1998), (5) to Schwab (1988), (6) to Brown and Frank (2018), (7) to Ministry of Agriculture, Lands and Food Production (1982), (8) to Quesnel (1979), (9) to Beard (1953), (10) to University of Florida Center for Aquatic and Invasive Plants (2022), (11) to Questelles (2016), (12) to Auguste and Hailey (2018), (13) to Lehtinen (2018), (14) to Ministry of Works and Transport (2017), (15) to Bahall (2017), (16) to Tobias (2015), (17) to Hosein et al. (2017), (18) to National Infrastructure Development Company Limited (2017), (19) to International Union for Conservation of Nature (2019), and (20) to Auguste et al. (2015). When a source is not included in the 'Species group' column, the identification of the group was included in the text of the source(s) for the 'Characteristic(s)' column.

Scientific name	*Common name*	*Species group*	*Characteristic(s)*	*Current IUCN Red List status*
Mauritia flexuosa	Moriche Palm	Flora → Tree	Abundance (1, 2); Disturbance (1)	N/A
Symphonia globulifera	Boarwood (19)	Flora → Tree	"Principal" part of forest (9)	LC
Clusia nemorosa		Flora → Tree	"Principal" part of forest (9)	LC
Clusia palmicida		Flora → Tree	"Principal" part of forest (9)	LC
Paspalum pulchellum Kunth		Flora → Grass	Abundance (3); Referred to as IS (4)	N/A
Panicum stenodes		Flora → Grass	Abundance (5)	N/A
Chrysobalanus icaco var. *pellocarpus*	Cocoplum (6)	Flora → Shrub or Tree (9)	Abundance (3, 9)	LC
Byrsonima crassifolia		Flora → Shrub	Abundance (3)	LC
Miconia ciliata		Flora → Shrub (7)	Abundance (8)	N/A
Rhynchospora podosperma		Flora → Sedge	Abundance (5)	N/A
Rhynchospora barbata		Flora → Sedge	Abundance (5); Referred to as IS (4)	N/A

Rhynchospora curvula		Flora → Sedge	Abundance (5)	N/A
Lagenocarpus rigidus		Flora → Sedge	Referred to as IS (4)	N/A
Lagenocarpus guianensus		Flora → Sedge	Abundance (9)	N/A
Drosera capillaris	Pink sundew (10)	Flora → Herb	Abundance (5)	N/A
Ilex arimensis	Biscuitwood	Flora	Referred to as IS (4); "Principal" part of forest (9)	N/A
Isertia parviflora	Wild ixora	Flora	Referred to as IS (4)	LC
Leptodactylus fuscus	Whistling frog (11)	Fauna → Amphibian	Conservation, speculated (12)	LC
Pristimantis urichi	Urich's robber frog (13)	Fauna → Amphibian	Conservation, speculated (12); IUCN Red List (14, 20)	LC
Scinax ruber	Brown tree frog (15)	Fauna → Amphibian	Conservation, speculated (12)	LC
Flectonotus fitzgeraldi	Dwarf marsupial frog (16)	Fauna → Amphibian	Conservation, speculated (12); IUCN Red List (14, 20)	LC
Dendropsophus goughi		Fauna → Amphibian	Conservation, speculated (12)	N/A
Orthopsittaca manilata	Red-bellied macaw	Fauna → Bird	Abundance (17)	LC
Amazona amazonica	Orange-winged parrot	Fauna → Bird	Abundance (17)	LC
Felis pardalis	Ocelot	Fauna → Mammal	Local conservation status (18)	LC

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