CONSERVATION ASSESSMENT OF PLAYA DELFÍN RAINFOREST RESERVE AND RESEARCH STATION, COSTA RICA

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ABSTRACT

Playa Delfín is located in southwestern Costa Rica on the Golfo Dulce coast across from the Osa Peninsula, and occupies an area of 115 ha with elevations ranging up to 145 m. The reserve is privately owned by Patrick and Anne Weston, and was purchased in 1988 to protect one of the last remaining tracts of primary forest in the region. A two-week botanical survey in 2011 aimed at assessing the conservation value of the site resulted in the documentation of 138 taxa of chiefly woody plants. Of these 101 were trees, 24 were shrubs, 6 were lianas, and 7 were herbs. Included in the list are twelve species considered to be rare or of restricted ranges, as well as three species representing first reports for the Osa Peninsula/Golfo Dulce region. Four major habitats are described along with typical species associated with each community. Primary forest occurred in the uplands and stream corridors while the lowland section was more disturbed but still contained a number of large trees. Five non-native species were documented in the lowlands but only *Gmelina arborea* was particularly invasive. These results suggest that a rich flora occurs at Playa Delfín, and, as it was also known to harbor a rich fauna, provides additional evidence of the high conservation value of the site. Already a part of Costa Rica's private forest reserve system, Playa Delfín received additional government protection as a result of this and other studies documenting the biological resources at the reserve.

RESUMEN

Playa Delfín está localizada en el suroeste de Costa Rica en la costa de Golfo Dulce de la Península Osa, y ocupa un área de 115 ha con elevaciones que llegan a 145 m. La reserva es propiedad privada de Patrick y Anne Weston, y fue comprada en 1988 para proteger uno de los últimos restos existentes de bosque primario de la región. Un estudio botánico de dos semanas en 2011 con el propósito de apreciar el valor de conservación del lugar dio como resultado documentar 138 taxa de plantas principalmente leñosas. De estas 101 fueron árboles, 24 arbustos, 6 lianas, y 7 herbáceas. Se incluyen en la lista doce especies consideradas raras o de rango reducido, así como tres especies que representan las primeras citas para la región de Península Osa /Golfo Dulce. Se describen cuatro hábitats mayores junto con las especies típicas asociadas con cada comunidad. El bosque primario aparece en las tierras altas y pasillos de arroyos mientras que la parte baja está más alterada, pero aun contiene cierto número de árboles grandes. Se documentaron cinco especies exóticas en las tierras bajas, pero solo *Gmelina arborea* es particularmente invasiva. Estos resultados sugieren que existe una flora rica en Playa Delfín, y, como ya se sabía alberga una fauna rica, aporta pruebas adicionales del alto valor de conservación del lugar. Como parte del sistema privado de reserva de bosques de Costa Rica, Playa Delfín recibe protección adicional del gobierno como resultado de este y de otros estudios que documentan los recursos biológicos de la reserva.

INTRODUCTION

This study was conducted at the Playa Delfín Rainforest Reserve and Research Station (hereafter referred to as Playa Delfín). The reserve is located in the southern Pacific lowlands of Costa Rica in the Canton de Golfito (Puntarenas Province), south of the town of Golfito near Pavones, on the eastern side of the Golfo Dulce, across the gulf from the Osa Peninsula. Playa Delfín is privately owned and encompasses one of the few remaining stands of primary forest in the region. The Golfo Dulce area is known as a region of great biological diversity due to its geologic and climatic history (Weber et al. 2001), but has also been severely impacted by various human activities in recent years. There have been several botanical studies that summarize floristic information for the Osa Peninsula and the Golfo Dulce regions, including Allen (1956), Quesada Quesada (1997), Weber et al. (2001), Aguilar et al. (2008 and onwards), and Gilbert et al. (2016), but there have been no published studies that deal specifically with the Playa Delfín area and vicinity. Muñoz (1990) provided a list of tree species for Playa Delfín in a report commissioned by the owners, but this report was based on observations and did not involve herbarium specimen documentation. The aim of this short term study was to conduct a conservation assessment of the site based on diversity of habitat, baseline species list, and presence of rare, endemic, and

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non-native species, and to submit a report on these findings to the owners and the Costa Rican government. Targeted groups for the study were woody plants, climbing plants, and conspicuous herbaceous species. Speciose families such as Araceae, Bromeliaceae, and Orchidaceae were excluded. The owners hoped to utilize this basic information on the plant biodiversity, along with other ongoing studies, to justify increased government protection.

STUDY AREA

Playa Delfín is a 115 ha preserve located in southern Costa Rica near the Panama border (Figs. 1, 2). The property is roughly rectangular, with the northeast corner near the mouth of Quebrada Higo at 8.407° N and 83.119° W, the northwest corner near the mouth of Quebrada Macho at 8.405° N and 83.124° W, and extending southeast generally along the corridors of the two quebradas, with the midpoint of the southern boundary at 8.392° N and 83.114° W, at the end of the Ridge Trail near a teak farm. Playa Delfín was purchased by Patrick and Anne Weston in 1988 to establish a home site and to protect the area from the deforestation and development that was occurring rapidly in the region. The site now includes a main house, five cabins, and a dining room/kitchen. Primary forest occupies about ¾ of the property, and there is a network of trails. The forest is part of Costa Rica's Private Forest Reserve system and is a refuge for many CITES-listed species of animals. Visitation by researchers is encouraged. Elevations range from 6–9 m along the coastal forest border, with a lowland section mostly below 45 m, and uplands rising to 145 m near the end of the Ridge Trail. The section of the preserve declared as *Zona Marítimo Terrestre* and *Zona Pública Inalienable* is a government-owned strip of land extending from the ocean to 200 m inland, mostly below 21 m in elevation, chiefly north of the main road, but also including a small section south of the road in the northwest corner of the preserve. The unforested areas in the lowlands include a small lake, fields in various successional stages, and an open, maintained area where the houses and cabins are located. Most of the property south of the road is forested, with primary forest occurring on the slopes and ridges. The trails are all easy walking except for some sections of the Ridge Trail that are narrow and steep. In the dry season it is possible to hike upstream in the two stream corridors for considerable distances. There are many scenic views along the streams, including winding and bouldery corridors, small waterfalls, and heavily forested slopes rising high above the streams.

In the Golfo Dulce region the dry season extends from December through April, and the rainy season from May to November (Weber et al. 2001). According to Anne Weston (pers. comm.), rainfall and temperature patterns at Playa Delfín are most similar to those at the Coto 47 weather station operated by the Instituto Nacional Meteorólogico near the town of Ciudad Neily. Rainfall is lowest from January to March and highest from August to November, averaging about 3000 mm annually. Nearby areas of Golfito, La Gamba, and the Osa Peninsula get much more rain than the Playa Delfín area, often 4500–6000 mm [Weber et al. (2001) and A. Weston, pers. comm.]. The average monthly temperatures are relatively stable, ranging from 30.4°C–33.6°C in the daytime and 21.0°C–23.2°C at night.

METHODS

This study was conducted during a two-week visit to the site, from June 28 to July 8, 2011. Species in each of the major habitats were documented with collections and photographs. Specimens were collected in triplicate, if possible, and were dried by the method described in Blanco et al. (2006). Diameter measurements were taken for any particularly large trees. The primary set of specimens was deposited at the Costa Rican Herbario Nacional (CR), with the remaining duplicates mailed to the U.S.A., and sets deposited at Eastern Kentucky University Herbarium (EKY) and the Missouri Botanical Garden (MO). References used for identifications and species distributions included the following books: Allen (1956), Condit et al. (2011), Gargiullo (2008), Gentry (1993), Hammel et al. (2003a, 2003b, 2004, 2007, 2010, 2014, 2015), Harmon (2004), Holdridge et al. (1997), Krings and Braham (2005), Quesada Quesada et al. (1997), Weber et al. (2001), Zamora and Pennington (2001), Zamora et al. (2000, 2004, 2011), and Zuchowski (2007). Angiosperm family classification follows Stevens (2001 onwards), and author abbreviations follow IPNI (2015). Pteridophyte family classification follows Smith et al. (2006). Binomial and trinomial nomenclature is based on the available volumes of *Manual de*

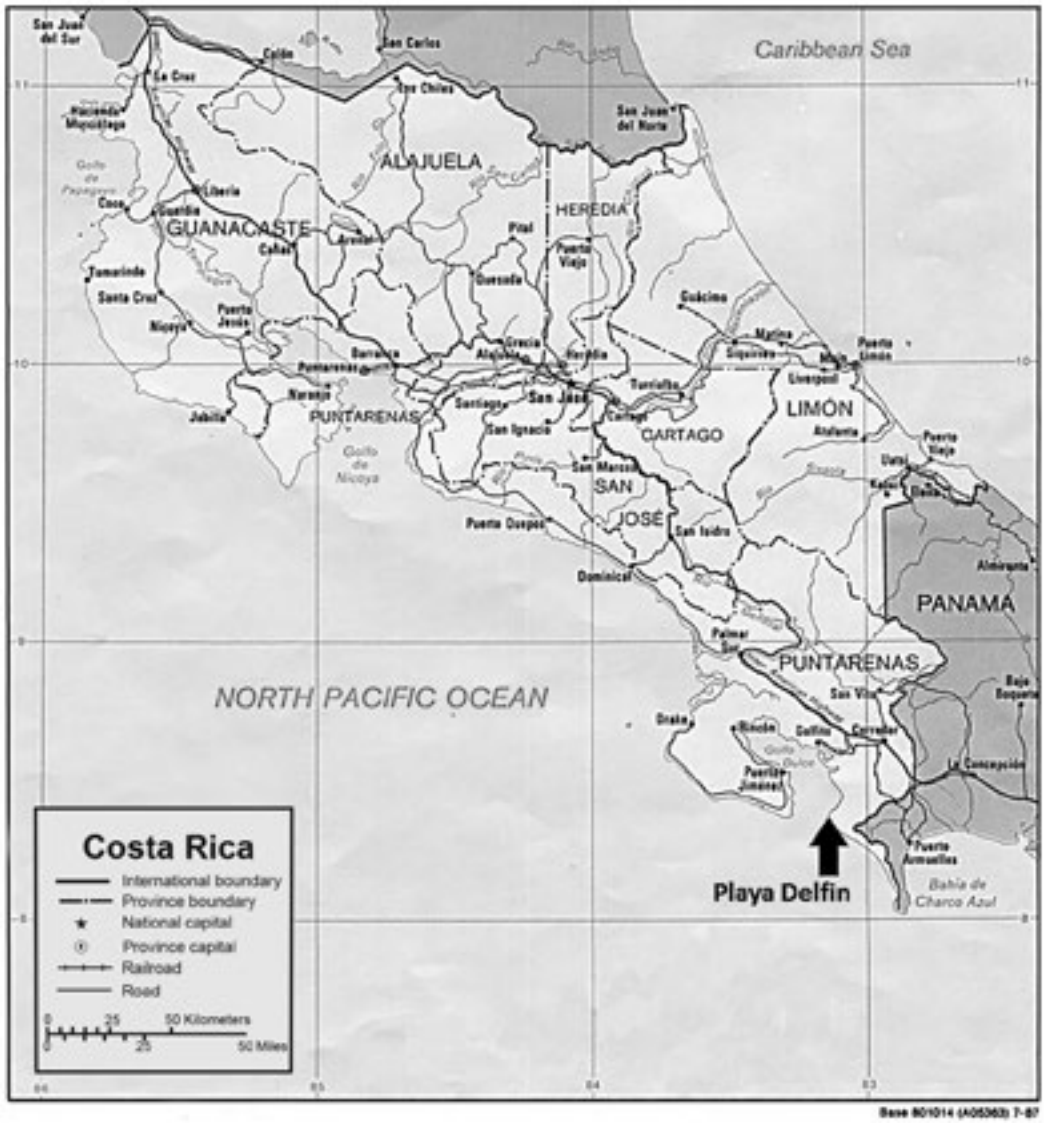

Fig. 1. Location of Playa Delfín in southern Costa Rica.

Plantas de Costa Rica (Hammel et al. 2003a, 2003b, 2007, 2010, 2014, and 2015), as well as names in the upcoming volume IV of the *Manual* (M. Grayum, pers. comm.).

RESULTS

Flora

A total of 138 different taxa were documented at Playa Delfín, and 128 (93%) were identified to species (Appendix I). Only a few ferns and monocots were collected. *Alsophila firma* was the only tree fern, occurring along the streams, and the climbing *Lygodium venustum* was collected from beach front vegetation. The Cyclanthaceae were represented by *Carludovica rotundifolia* and *Cyclanthus bipartitus*, both occurring along streams, and a grass, *Uniola pittieri*, was a conspicuous component of the beachfront vegetation. Five species in

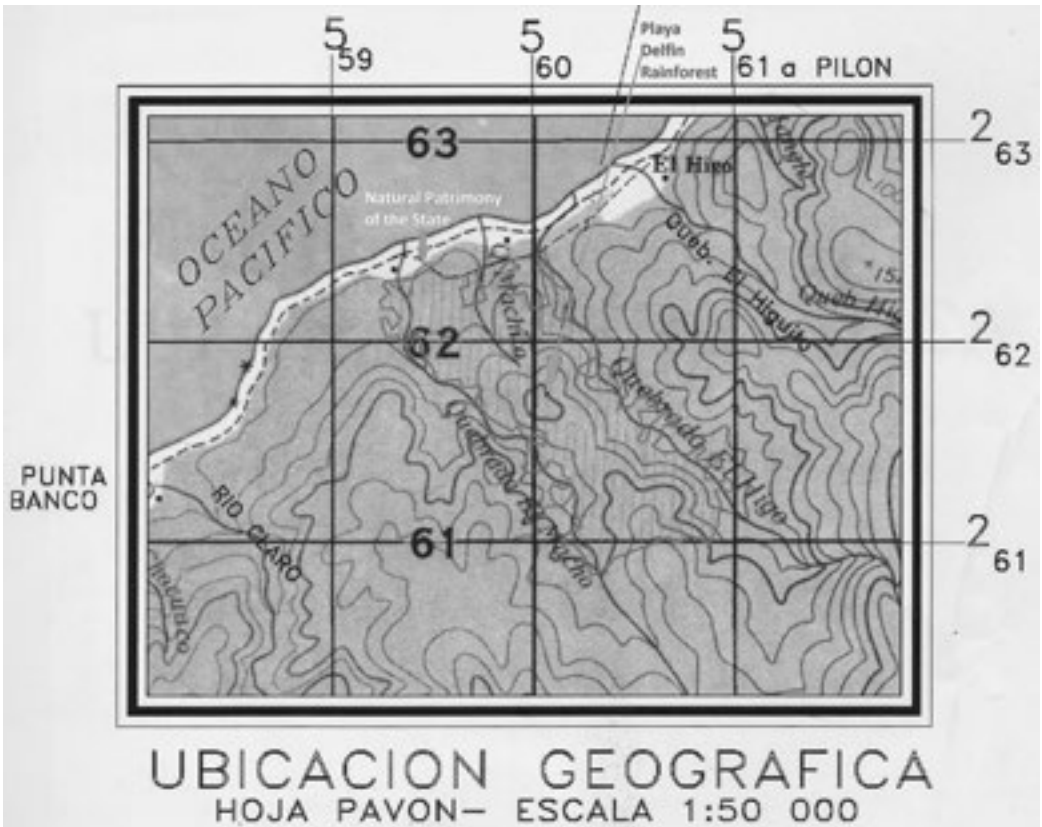

Fig. 2. Topographic map of Playa Delfín, between Quebrada Higo and Quebrada Macho.

the Arecaceae were noted, *Bactris major* and *Chamaedorea tepejilote*, both shrubby palms, and the taller *Cocus nucifera* along the coast, *Attalea rostrata* in the lowlands, and *Astrocaryum standleyanum* in the uplands. Tall herbs included *Hellenia speciosa* and two species of *Heliconia*.

The most commonly encountered dicot families were the Fabaceae (18 species), Malvaceae (11), Rubiaceae (12), and Moraceae (10). The following genera were represented by three or more species: *Ficus* (7 species), *Inga* (4). *Miconia* (3), and Piper (4). There were 101 trees, 24 shrubs, 6 lianas, and 7 herbs.

A number of large trees (1–2 m dbh) occurred in the uplands, including individuals of *Brosimum utile, Copaifera aromatica, Ficus* spp., *Hura crepitans,* and *Pseudobombax septenatum*. The largest trees observed were a *Hura crepitans,* on the east side of the Ridge Trail, that was about 3 m dbh, and a strangler fig near the junction of the Entry Trail and Ridge Trail, composed of a massive complex of stems over 5 m wide. Large trees were also present in the lowlands, including a *Caryocar costaricense* at 2.2 m in diameter on the Ajo Trail and several large fig trees in the forests near the beach.

In an earlier survey of Playa Delfín (Muñoz 1990), the following 16 taxa (with updated names) were reported, but these were not documented in this study: *Brosimum costaricanum* Liebm., *Brunellia costaricensis* Standl., *Bursera simaruba* (L.) Sarg , *Calophyllum brasiliense* Cambess., *Ceiba pentandra* (L.) Gaertn., *Chimarrhis latifolia* Standl., *Dialium guianense* (Aubl.) Sandwith, *Garcinia* sp., *Gaurea* sp., *Licania arborea* Seem., *Qualea* sp., *Rollinia* sp., *Sapium* sp , *Terminalia amazonia* (J.F. Gmel.) Exell, *T. oblonga* (Ruiz & Pav.) Steud., and *Thouinidium decandrum* (Bonpl.) Radlk. The accuracy of this list could not be determined as there was no herbarium documentation. Many of these were listed by Quesada Quesada et al. (1997) as occurring in the Osa Peninsula

region. If present, these species were likely just overlooked in this short two-week study. In particular, it was pointed out by Anne Weston that *Ceiba pentandra* was known to occur in the uplands.

Endemic, Endangered, Exotic, and other Notable Species

The following species are notable either as endemics, as IUCN species, as species of restricted range, or as new reports for the region. Two species, *Buchenavia costaricensis* collected along Quebrada Higo, and *Piper pseudodilatatum* collected on the ridge trail are endemic to the southwestern coastal region of Costa Rica. Two species are listed by IUCN (2016) as Vulnerable within their range: *Caryocar costaricense*, collected in the lowlands, and *Tocoyena pittieri*, collected along Quebrada Macho; *Cecropia obtusifolia*, in both lowlands and uplands, is listed by IUCN (2016) as a species of Least Concern. *Copaifera aromatica* is known primarily from Panama, with a few scattered occurrences in Costa Rica and Nicaragua. *Caryocar costaricense* and *Mortoniodendron anisophyllum* are known chiefly from Costa Rica and Panama, with a few scattered sites in northern South America. Five species, *Gonzalagunia osaensis*, *Hamelia magnifolia*, *Heliconia stilesii*, *Piper culebranum,* and *P. tapianum* are known only from Costa Rica and Panama. The following native species were not listed in other available lists for the region (Aguilar et al. 2008 and onward; MNCR 2013; Weber et al. 2001: *Piper culebranum*, *P. pseudodilatatum*, and *P. tapianum*.

Naturalized species collected at Playa Delfín were: *Cananga odorata, Hellenia speciosa, Gmelina arborea, Ixora coccinea,* and *Terminalia catappa*. All were found in the lowlands or along the beach. *Terminalia catappa* is a conspicuous component of the seaside vegetation, but of the other species, only *Gmelina arborea* appears to be of major concern as an invasive within the natural vegetation of the lowlands.

Habitats and Life Zones

Four major habitats were delineated by elevation and topography: coastal fringe along the beach and below 10 m elevation, lowland interior from 10 to 45 m, stream corridors, and uplands from 45–145 m.

The larger trees along the beach were individuals of *Cocos nucifera, Hymenaea courbaril*, and *Terminalia catappa*. The coastal fringe forest also included the following species: *Amphitecna latifolia, Bunchosia nitida, Chrysobalanus icaco, Taliparitis tiliaceum* var. *pernambucense, Hippomane mancinella, Randia aculeata*, and *Ximenia americana*. An extensive ground cover was formed by the tangled stems of the yellow-flowered *Sphagneticola trilobata*. A grass, *Uniola pittieri*, and a legume, *Canavalia rosea*, were conspicuous in patches along the beach.

The Lowland Interior community included *Aspidiosperma desmanthum, Astronium graveolens, Bactris major, Byrsonima crassifolia, Cananga odorata, Cecropia obtusifolia., Ficus* spp., *Gmelina arborea, Guazuma ulmifolia*, both *Handroanthus* species, *Hymenaea courbaril*, all of the *Inga* spp., Jacaranda *caucana, Lonchocarpus heptaphyllus, Luehea seemanii, Myriocarpa longipes, Ochroma pyrimadale, Platymiscium* sp., *Pochota fendleri, Simaba cedron, Tabebuia rosea*, *Trema micrantha*, *Vitex cooperi*, and *Zanthoxylum riedelianum*. This lowland section had been heavily disturbed, as evidenced by some old buildings and open areas, the presence of non-native species, as well as a number of planted species. Several large native trees do continue to exist in this community.

Several species were only observed only in the stream corridors, including, *Alchornea costaricensis, Alsophila firma, Buchenavia costaricensis, Carludovica rotundifolia, Carapa nicaraguensis, Cyclanthus bipartitus, Hamelia magnifolia, H. patens, Heliconia stilesii, Mortoniodendron anisophyllum, Posoqueria latifolia, Sterculia apetala*, and *Tocoyena pittieri*. Primary forest occurred along the stream corridors, as evidenced by the presence of many large trees.

Most of the collecting in the uplands was accomplished along the Ridge Trail; canopy species along this trail included the following: *Apeiba tibourbou, Astrocaryum standleyanum, Brosimum utile, Chrysophyllum cainito, Cojoba arborea, Copaifera aromatica, Ficus tonduzii., Goethalsia meiantha, Guatteria amplifolia, Hura crepitans, Luehea seemannii, Licaria misantlae, Platymiscium* sp., *Pseudobombax septenatum, Pterocarpus hayesii, Spondias mombin, Virola sebifera,* and *Vochysia guatemalensis*. Among the smaller trees *Castilla tunu* and *Heisteria acuminata* were conspicuous in the understory. There were many large trees and much of the upland habitat is occupied by primary forest.

According to Weber et al. (2001) the life zones of the Golfo Dulce region are classified in the Holdridge system as either Tropical Wet Forest, Tropical Moist Forest, or Tropical Premontane Wet Forest. Holdridge (1971) mapped the Playa Delfín area as Tropical Moist Forest. The coastal fringe plant communities along the coast have been described as Coastal and Beach Vegetation in Weber et al. (2001) and as Littoral Woodland in Allen (1956). Allen (1956) was more specific in his community descriptions for Golfo Dulce forests, and his account of the species occurring in the beach-front forest is very similar to ours. Many of the species listed for the Lowland Interior and Uplands and Ridges in this report were included by Allen (1956) in his Evergreen Lowland Forest.

Conservation Value of Playa Delfín

The goals of this study were to determine the different kinds of habitats at Playa Delfin, to provide a baseline account of the targeted vascular plant groups at Playa Delfin, and to submit a report (Jones & Jiménez 2011) to the owners and to the Costa Rican government on the conservation value of the site. This study documented the presence of 138 vascular taxa, including 101 trees, and four major habitat types. Two of the trees are endemic species, and there are three species listed in the IUCN Redbook. In addition eight of the species have relatively restricted distribution and three have not been previously reported from the area. At the present time there is not a major problem with invasive species at Playa Delfín, with only *Gmelina arborea* actively spreading in the lowlands.

The beach, lowlands, stream corridors, and uplands at Playa Delfín provide a diversity of habitats and likely harbor a rich assemblage of plant and animal species. The information gathered in this short-term study suggests that a rich native flora exists at the site and that further and more extensive studies will no doubt reveal many additional taxa and many more species of conservation concern. A number of studies have documented the rich variety of wildlife in the region (Brechter 2007; Savage 2002; Tebb 2008; Wainwright 2002), and there have been a number of sightings at Playa Delfín of rare mammals, birds and other wildlife (Anne Weston, pers. comm.). Many of the plant species documented at Playa Delfin are known to produce fruits important to a wide variety of wildlife (Wainwright 2002). The available information suggests, therefore, that Playa Delfin, with its diversity of habitat and potentially rich flora and fauna, is a site of high conservation value, and worthy of additional government protection.

It can be readily observed from Google Earth images that the 115 ha that make up the Playa Delfín Rainforest Reserve and Research Station represent one of the largest remaining tracts of primary forest in the region. Other tracts occur southeastward, some private and some protected, but together these form a nearly continuous corridor from the Pacific Ocean to the Panama border, increasing the potential benefits of utilizing Playa Delfín as a reservoir for maintaining plant and animal biodiversity in this unique and highly threatened region of Costa Rica.

As a result of this and other studies, the entire beach front property at Playa Delfín was declared in 2014 as Natural Patrimony of the State, administered by the Ministry of Natural Resources. Local officials had been planning to issue permits for beachfront development in this area, and this classification effectively prevents such construction projects from occurring.

APPENDIX 1

Vascular plants documented at Playa Delfín. Species names are followed by RLJ collection number, growth habit, and habitat. Naturalized species are indicated by an asterisk (*) and planted species by a caret (^).

Acanthaceae
Aphelandra lingua-bovis Leonard–10756; shrub. Streams.

Actinidaceae
Saurauia yasicae Loes.–10765; tree. Streams.

Anacardiaceae
Astronium graveolens Jacq.–10846; tree. Lowlands.
Spondias mombin L.–10798; tree. Uplands.

Annonaceae
^*Annona muricata* L.–10855; tree. Lowlands
Annona sp. 2–10837; tree. Streams.
**Cananga odorata* (Lam.) Hook. f. & Thomson–10733, 10822; tree. Lowlands.
Guatteria amplifolia Triana & Planch.–10813; tree. Uplands.

Apocynaceae
Aspidosperma desmanthum Benth. ex Müll.Arg.–10781; tree. Lowlands.

Arecaceae
Astrocaryum standleyanum L.H. Bailey–10705; tree. Uplands.

Attalea rostrata Oerst.–0854; tree. Lowlands.
Bactris major Jacq.–10736; shrub. Lowlands.
Chamaedorea tepejilote Liebm.–10773; shrubby palm. Streams.
Cocos nucifera L.–10853; tree. Beach.

Aristolochiaceae
Aristolochia sp. 1 10856; liana. Uplands.

Asteraceae
Sphagneticola trilobata (L.) Pruski–10750; sprawling herb. Beach.
Vernonia patens Kunth–10800; shrub. Lowlands.

Bignoniaceae
Amphitecna latifolia (Mill.) A.H. Gentry–10734; tree. Beach.
Handroanthus guayacan (Seem.) S.O. Grose–10848; tree. Lowlands.
Handroanthus ochraceus (Cham.) Mattos–10844; tree. Lowlands.
Jacaranda caucana Pittier–10751, 10850; tree. Lowlands.
Lundia corymbifera (Vahl) Sandwith–10797; liana. Lowlands.
Tabebuia rosea (Bertol.) DC.–10785, 10843; tree. Lowlands.

Burseraceae
Protium tenuifolium Engl.–10807; tree. Uplands

Cannabaceae
Trema micrantha (L.) Blume–10784, 10824; tree. Lowlands.

Caryocaraceae
Caryocar costaricense Donn.Sm.–10732; tree. Lowlands.

Chrysobalanaceae
Chrysobalanus icaco L.–10743; tree. Beach.
Moquilea platypus Hemsl.–10782; tree. Lowlands.

Combretaceae
Buchenavia costaricensis Stace–10764; tree. Streams.
**Terminalia catappa* L.–10746; tree. Beach.

Costaceae
**Hellenia speciosa* (J. Koenig) Govaerts–10820; tall herb. Lowlands.

Cyatheaceae
Alsophila firma (Baker) D.S. Conant–10755; tree fern. Streams.

Cyclanthaceae
Carludovica rotundifolia H. Wendl.–10776; tall herb. Streams.
Cyclanthus bipartitus Poit.–10777; tall herb. Streams.

Erythropalaceae
Heisteria acuminata (Humb. & Bonpl.) Engl.–10711; shrub. Uplands.

Euphorbiaceae
Alchornea costaricensis Pax & K. Hoffm.–10771; tree. Streams
Hippomane mancinella L.–10847; tree. Beach.
Hura crepitans L.–10704; tree. Uplands.

Fabaceae
Canavalia rosea (Sw.) DC.–10793; liana. Beach.
Cassia grandis L.f.–10788, 10811; tree. Lowlands.
Cojoba arborea (L.) Britton & Rose–10787, 10802; tree. Uplands.
Copaifera aromatica Dwyer–10799; tree. Uplands.
Dalbergia brownei (Jacq.) Schinz–10747; liana. Beach.
^*Dalbergia retusa* Hemsl.–10700; tree. Lowlands.
Hymenaea courbaril L.–10725, 10780, 10821; tree. Lowlands.
Inga densiflora Benth.–10749; tree. Lowlands.
Inga punctata Willd.–10727; tree. Lowlands.
Inga spectabilis (Vahl) Willd.–10748; tree. Lowlands.
Inga thibaudiana DC.–10845; tree. Lowlands.
Lonchocarpus heptaphyllus (Poir.) DC.–10744; tree. Lowlands.
Machaerium kegelii Meisn.–10831; tree. Streams.
Platymiscium sp.–10739; tree. Lowland and upland.
Pterocarpus hayesii Hemsl.–10814; tree. Uplands.
Samanea saman (Jacq.) Merr.–10723; tree. Lowlands.
Senna reticulata (Willd.) H.S. Irwin & Barneby–10728; tree. Lowlands.
Swartzia ochnacea DC.–10830; tree. Streams.

Gesneriaceae
Besleria hirsuta (Oerst.) Hanst.–10757; shrub. Streams.

Heliconiaceae
Heliconia stilesii W.J. Kress–10766. Tall herb. Streams.
Heliconia sp. 1.–10857. Tall herb. Streams.

Hypericaceae
Vismia baccifera (L.) Planch. & Triana–10809; tree. Lowlands.

Lamiaceae
Callicarpa acuminata Kunth–10816; shrub. Lowlands.
Cornutia pyramidata L.–10826; tree. Lowlands.
**Gmelina arborea* Roxb.–10828; tree. Lowlands.
Vitex cooperi Standl.–10702, 10730, 10789; tree. Lowlands.

Lauraceae
Licaria misantlae (Brandegee) Kosterm.–10712; tree. Uplands.
Lauraceae sp. 2. 10840; tree. Streams.

Lethycidaceae
Grias cauliflora L.–10708; tree. Uplands.

Lygodiaceae
Lygodium venustum Sw.–10753; liana. Beach.

Malphigiaceae
Bunchosia nitida (Jacq.) DC.–10731; tree. Beach.
Byrsonima crassifolia (L.) Kunth–10722; tree. Lowlands.

Malvaceae
Apeiba tibourbou Aubl.–10721, 10724; tree. Uplands.
Goethalsia meiantha (Donn.Sm.) Burret–10801; tree. Uplands.
Guazuma ulmifolia Lam.–10786; tree. Lowlands.
Luehea seemannii Planch. & Triana–10707; tree. Uplands.
Mortoniodendron anisophyllum (Standl.) Standl. & Steyerm.–10772; tree. Streams.
Ochroma pyramidale (Cav. ex Lam.) Urb.–10849; tree. Lowlands.
Pochota fendleri (Seem.) W.S. Alverson & M.C. Duarte–10738; tree. Lowlands.
Pseudobombax septenatum (Jacq.) Dugand–10852; tree. Lowlands and uplands.
Sterculia apetala (Jacq.) H.Karst.–10851; tree. Streams.
Taliparitiliaceum (L.) Fryxell var. *pernambucense* (Arruda) Fryxell–10745; shrub. Beach.
Triumfetta lappula L.–10823; tree. Lowlands.

Melastomataceae
Miconia argentea (Sw.) DC.–10726; tree. Streams.
Miconia sp. 2.–10713; tree. Uplands.
Miconia sp. 3.–10763; tree. Streams.

Meliaceae
Carapa nicaraguensis C.DC.–10767, 10769; tree. Streams.
Guarea chiricana Standl.–10768, 10803, 10808; tree. Streams.

Menispermaceae
Hyperbaena leptobotryosa (Donn.Sm.) Standl.–10812; shrub. Lowlands.

Moraceae
Brosimum utile (Kunth) Oken.–10717; tree. Uplands.
Castilla tunu Hemsl.–10720; tree. Uplands.
^*Ficus elastica* Roxb.–10737; tree. Lowlands.
Ficus insipida Willd.–10783; tree. Lowlands.
Ficus tonduzii Standl.–10703; tree. Uplands.
Ficus sp. 4.–10791; tree. Lowlands.
Ficus sp. 5–10572; tree. Lowlands.
Ficus sp. 6–10790; tree. Lowlands.

Ficus sp. 7–10805; tree. Uplands.
Sorocea pubivena Hemsl.–10710; tree. Uplands.

Myristicaceae
Otoba novogranatensis Moldenke–10761; tree. Streams.
Virola sebifera Aubl.–10718; tree. Uplands.

Myrtaceae
Myrcia splendens (Sw.) DC.–10762; tree. Streams.

Phyllanthaceae
Hieronyma alchorneoides Allem.–10810; tree. Uplands.
Margaritaria nobilis L.f.–10818; tree. Lowlands.

Piperaceae
Piper auritum Kunth–10770; shrub. Streams.
Piper culebranum C.DC.–10778; shrub. Streams.
Piper pseudodilatatum C.DC.–10714; shrub. Uplands.
Piper tapianum Trel.–10729; tree. Lowlands.

Poaceae
Uniola pittieri Hack.–10792; herbaceous grass. Beach.

Polygonaceae
Coccoloba obovata Kunth–10819; tree. Lowlands.

Primulaceae
Ardisia opegrapha Oerst. subsp. *opegrapha*–10833; shrub. Streams.

Rubiaceae
Chomelia microloba Donn.Sm.–10834, 10839; shrub. Streams.
Gonzalagunia osaensis C.M. Taylor–10836; shrub. Streams.
Guettarda foliacea Standl.–10817; tree. Lowlands.
Hamelia magnifolia Wernham–10758, 10774; shrub. Streams.
**Ixora coccinea* L.–10742; shrub. Beach.
Palicourea guianensis Aubl.–10701; tree. Lowlands.
Posoqueria latifolia (Rudge) Roem. & Schult.–10838; tree. Streams.
Psychotria grandis Sw.–10759; tree. Streams.
Psychotria sp.–10775; tree. Streams.
Randia aculeata L.–10740, 10795; shrub. Beach.
Tocoyena pittieri (Standl.) Standl.–10842; tree. Streams.
Rubiaceae sp. 12.–10829; tree. Streams.

Rutaceae
Zanthoxylum riedelianum Engl.–10827; tree. Lowlands.

Santalaceae
Phoradendron robustissimum Eichler–10794; parasitic shrub. Lowlands

Sapindaceae
Dilodendron costaricense (Radlk.) A.H.Gentry & Steyerm.–10804; tree. Uplands.

Sapotaceae
Chrysophyllum cainito L.–10709; tree. Uplands.
Pouteria glomerata (Miq.) Radlk.–10841; tree. Uplands.
Pouteria subrotata Cronquist.–10806; tree. Uplands.

Simaroubaceae
Simaba cedron Planch.–10735; shrub. Lowlands.

Solanaceae
Cestrum schlechtendalii G. Don–10835; shrub. Streams.
Solanum splendens (Dunal) Bohs.–10760; shrub. Streams.
Solanaceae sp. 3.–10754; tree. Streams.

Urticaceae
Cecropia obtusifolia Bertol.–10715; tree. Lowlands and uplands.
Coussapoa villosa Poepp. & Endl.–10805; tree. Uplands.
Myriocarpa longipes Liebm.–10779, 10832; tree. Streams.

Verbenaceae
Lantana camara L.–10825; shrub. Lowlands.

Vitaceae
Cissus biformifolia Standl.–10815; liana. Lowlands.

Vochysiaceae
Vochysia guatemalensis Donn.Sm.–10706; tree. Uplands.

Ximeniaceae
Ximenia americana L.–10741, 10796; shrub. Beach.

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