

The Journal of Caribbean Ornithology

RESEARCH ARTICLE

Vol. 32:57–64. 2019

Impact of an invasive fern (*Dicranopteris pectinata*) on
bird diversity and birdwatching in a Jamaican Ramsar Site

Suzanne Davis

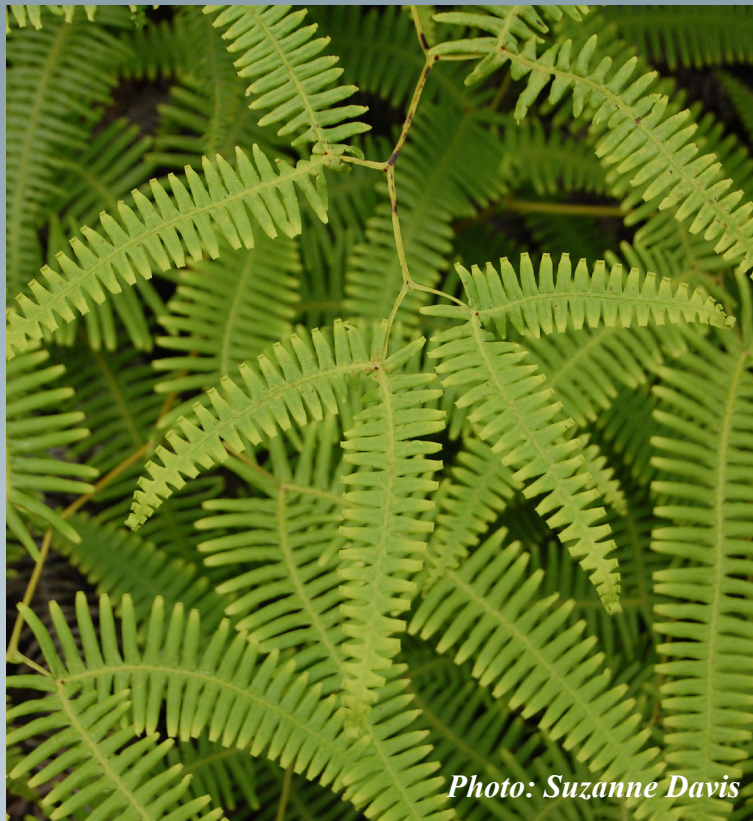


Photo: Suzanne Davis

Impact of an invasive fern (*Dicranopteris pectinata*) on bird diversity and birdwatching in a Jamaican Ramsar Site

Suzanne M. C. Davis

Abstract The comb forkedfern (*Dicranopteris pectinata*, syn. *Gleichenella pectinata*) is a fern species native to the New World tropics and reported as an invasive in protected areas in the Dominican Republic and Jamaica. This preliminary study investigated the impact of increases in abundance of *D. pectinata* on bird diversity and the birdwatching experience for visitors to a small protected area in central Jamaica, an upland scrub savanna within the Mason River Protected Area (MRPA). I calculated the extent of the fern's invasion along the length of the main visitor trail, and conducted point counts of resident and migrant birds along the same trail to determine bird species richness and composition. I assessed implications of the fern's invasion for ecosystem services, specifically those that are categorized as supporting and cultural. *D. pectinata* has invaded slightly less than 20% of the total length of the main visitor trail. The fern is a threat to plant diversity and may have reduced availability of suitable bird habitat. Fewer bird species, particularly endemics and winter migrants, were detected in fern-invaded habitats than in non-invaded habitats. I recommend that the managers of the Mason River Protected Area should place greater priority on controlling the spread of the invasive fern.

Keywords bird diversity, comb forkedfern, *Dicranopteris pectinata*, fern-invaded trail, invasion impact, Jamaica, scrub savanna.

Resumen Impacto de un helecho invasor (*Dicranopteris pectinata*) en la diversidad de aves y la observación de aves en un sitio Ramsar de Jamaica—*Dicranopteris pectinata*, syn. *Gleichenella pectinata* es una especie de helecho nativa de los trópicos del Nuevo Mundo y registrada como invasora en áreas protegidas de la República Dominicana y Jamaica. Este estudio preliminar investiga el impacto del incremento de la abundancia de *D. pectinata* en la diversidad de aves y en la experiencia de observación de aves para los visitantes de una pequeña área protegida en la zona central de Jamaica. El sitio de estudio es una sabana arbustiva montana dentro del área protegida de Mason River. Calculé el alcance de la invasión de esta especie de helecho a lo largo del sendero principal de visitantes y llevé a cabo puntos de conteo de las aves nativas y migratorias a lo largo del mismo sendero para determinar la composición y la riqueza de especies de aves. Se consideran las implicaciones de la invasión del helecho a los servicios de los ecosistemas, específicamente aquellos que están categorizados como de apoyo y culturales. El sendero principal de visitantes ha sido invadido por el helecho en algo menos del 20% de su longitud total. Esta especie es una amenaza a la diversidad florística y puede haber reducido el hábitat apropiado para las aves. Se detectaron menos especies de aves, principalmente endémicas y migrantes invernales, en hábitats invadidos que en los no invadidos. Recomiendo que los administradores del área protegida de Mason River den una mayor prioridad al control de la dispersión de este helecho invasor.

Palabras clave Comb forkedfern, *Dicranopteris pectinata*, diversidad de aves, impacto de la invasión, Jamaica, sabana arbustiva, sendero invadido por helechos

Résumé Incidence d'une fougère envahissante (*Dicranopteris pectinata*) sur la diversité de l'avifaune et l'observation des oiseaux sur un site Ramsar en Jamaïque—La fougère *Dicranopteris pectinata* (syn. *Gleichenella pectinata*) est une espèce originaire des tropiques du Nouveau Monde, signalée comme envahissante dans les aires protégées de République dominicaine et de Jamaïque. Cette étude préliminaire analyse l'impact de l'augmentation de l'abondance de *D. pectinata* sur la diversité de l'avifaune et l'observation des oiseaux par les visiteurs dans une petite aire protégée au centre de la Jamaïque, une savane arbustive des hautes terres située dans l'aire protégée de la Mason River. L'étendue de l'invasion de la fougère le long du sentier principal a été calculée, et des comptages par points des oiseaux indigènes et migrateurs ont été effectués le long du même sentier pour déterminer la richesse et la composition spécifiques. Les incidences de l'invasion de cette fougère sur les services écosystémiques, en particulier ceux considérés comme des services de soutien et des services culturels, ont été évaluées. La

fougère a envahi le sentier principal des visiteurs sur un peu moins de 20 % de sa longueur totale. Sa présence menace la diversité des plantes et pourrait avoir réduit l'habitat propice aux oiseaux. Le nombre d'espèces, en particulier endémiques

Natural History Museum of Jamaica, Institute of Jamaica, 10–16 East Street, Kingston, Jamaica; e-mail: sdavis@nhmj-ioj.org.jm

et migratrices hivernantes, détectées dans les habitats envahis était plus faible que dans les habitats non envahis. Il est recommandé aux gestionnaires de l'aire protégée de la Mason River d'accorder une plus grande priorité au contrôle de la propagation de cette fougère.

Mots clés *Dicranopteris pectinata*, diversité des oiseaux, impact de l'invasion, Jamaïque, savane arbustive, sentier envahi par les fougères.

The contribution of invasive plants to the loss or degradation of bird habitat and any subsequent decline in avian diversity remains an under-studied topic in Caribbean ecology. Moreover, where invasive plants are of interest, they tend to be alien invasive species, with little attention being paid to native invasive plant impacts. My research focuses on the impact of the native invasive comb forkedfern (*Dicranopteris pectinata*, syn. *Gleichenella pectinata*). Although it is native to the New World tropics, the dominance of this fern at certain sites may pose a threat to Caribbean biodiversity. Under environmental conditions favorable to its persistent spread, the fern literally invades new areas and threatens the survival of other plant species. It has been reported from the Greater and Lesser Antilles, Trinidad and Tobago, and continental America (Proctor 1985). The fern is a problem in at least two Caribbean protected areas, Mason River Protected Area (MRPA) in Jamaica and the Ébano Verde Scientific Reserve in the Dominican Republic (Slocum *et al.* 2006). The fern's impacts on avifauna in the MRPA are presented in this paper.

Despite the MRPA's small size of 82 ha, 430 species of plants, of which 11% are endemic to Jamaica (K. Campbell, pers. comm.), and 54 species of birds have been recorded from MRPA (Davis 2003). Inventories are being conducted to catalog the variety of resident insects, reptiles, and bats. The first known record of bird observations in the wetland was made by two members of the Gosse Bird Club (now BirdLife Jamaica) in 1969 (Smith 1969). There was a long gap in documented bird sightings until an avifauna survey and inventory was conducted in 2000–2001 through a BirdLife Jamaica and Institute of Jamaica project (Davis 2003). Based on the scarcity of bird surveys, knowledge of avian diversity at MRPA is incomplete and the threats to bird species are inadequately monitored. Of special concern is the threat of *D. pectinata* to bird habitats. The perception of this fern as aggressive and life-depriving has led to its local name, "vampire fern."

A member of the family *Gleicheniaceae*, *D. pectinata* is one of the more common members of its genus in humid subtropical and tropical regions of the world (Zhao *et al.* 2012). This terrestrial climbing fern tends to establish itself in open, moist, disturbed areas at various elevations. It is found in various types of habitats including forest gaps, mountain ridges, landslides, burned areas, and abandoned agricultural lands. As a colonizer of acidic and nutrient-poor soils, the fern forms a thicket that eventually dominates the understory and produces leaf litter that decomposes slowly relative to other ferns (Slocum *et al.* 2006, Zhao *et al.* 2012). The resultant disruptions to ecosystem processes and communities have been documented as 1) preventing bird-dispersed seeds from reaching soil; 2) inhibition of seed growth

and tree regeneration due to reduction in sunlight and deep leaf litter; 3) impacts on soil erosion and nutrient cycling; and 4) prevention of primary and secondary succession (Shiels and Walker 2003, Slocum *et al.* 2006, Zhao *et al.* 2012).

Over a 45-yr period since *D. pectinata* was first mapped in MRPA by Weck (1970), the fern has expanded its range and the number of patches where it dominates the habitat. This appears to have reduced the species richness of trees and shrubs in these patches, which in turn seems to have led to fewer birds being observed along trails invaded by the fern. Thus, the invasive fern has raised concerns about its impact on biodiversity, the nature walk experience, and guided tours offered by the Natural History Museum of Jamaica (NHMJ). Ecosystem services, defined here as the benefits people obtain from ecosystems (Millennium Ecosystem Assessment 2005) that are offered by this Ramsar Site, will inevitably be affected.

With the overall goal of investigating the impact of *D. pectinata* on bird diversity and birdwatching at MRPA, my study's objectives were to: 1) estimate the extent of *D. pectinata* invasion along a main visitor trail; 2) conduct a preliminary assessment of bird species richness and composition for fern-invaded and non-invaded habitat along a main visitor trail; and 3) make recommendations to the managers of the MRPA, namely the NHMJ, a division of the Institute of Jamaica, that will assist in planning for bird conservation. Implications of the fern's invasion for ecosystem services, specifically those that are categorized as supporting and cultural, are also considered.

Methods

The MRPA is located in hilly central Jamaica and features a rare wetland ecosystem. The boundary between Saint Ann Parish and Clarendon Parish intersects the MRPA at an altitude of ~670 m above sea level. However, northern Clarendon Parish has traditionally been credited with containing the entirety of the protected area (18°11'45.5"N, 77°15'24.8"W). The MRPA has not only been declared a Protected Area but also a Game Sanctuary (for pigeons and doves) and a Protected National Heritage Site under Jamaican laws. In 2011, MRPA was declared a Ramsar Site, giving it international recognition as a wetland of global importance. MRPA is owned by the Jamaica National Heritage Trust, which before becoming an autonomous entity was the Jamaica National Trust Commission, a former arm of the Institute of Jamaica (IOJ). The NHMJ, which serves as the science division of the IOJ, has been the designated manager of the protected area for ~50 years.

The MRPA wetland ecosystem of ~49 ha is a habitat island surrounded by extensive rural agriculture and residences. It consists primarily of a scrub savanna that is periodically flooded by rain-

fall and is interspersed by Jamaica's only reported upland peat bog, a marsh, surface depressions, and a stream (Proctor 1970, Weck 1970, White 1991). The existing savanna vegetation comprises mainly a dense growth of grasses, sedges, melastomes, and ferns, with some remnant large trees, particularly in a section that has regenerating forest. Most of the vegetation cover is under 2 m tall, with a few bamboo (*Bambusa vulgaris*) patches and trees such as autograph tree (*Clusia rosea*) and soapwood (*Clethra occidentalis*) exceeding 3 m.

At least five patches of *D. pectinata* are established across the wetland ecosystem, except for the western part of the wetland where, curiously, the fern is absent. *D. pectinata* forms dense thickets that may grow up to heights of almost 2 m at MRPA. To the naked eye, *D. pectinata* looks similar to some *Gleichenia* spp. but can be morphologically differentiated by the many fine hairs on its stems, best seen under a microscope (Proctor 1985).

I conducted field research along a main visitor trail called the Loop Trail and along an intersecting trail called the Cross Trail in March and April 2012 (Fig. 1). The Loop Trail is used for nature walks and guided tours through the scrub savanna. Reference to a 2005 Google Earth satellite image clearly indicated the spatial distribution of *D. pectinata*. The lighter green of the fern contrasts with the darker green of non-invaded vegetation. The trails were partially obscured on the satellite image. To relate the distribution and extent of the fern to the trails and to assess the invasion along the trails, I mapped the two trails using a global positioning system (Garmin® GPS Map 76CSx; Garmin

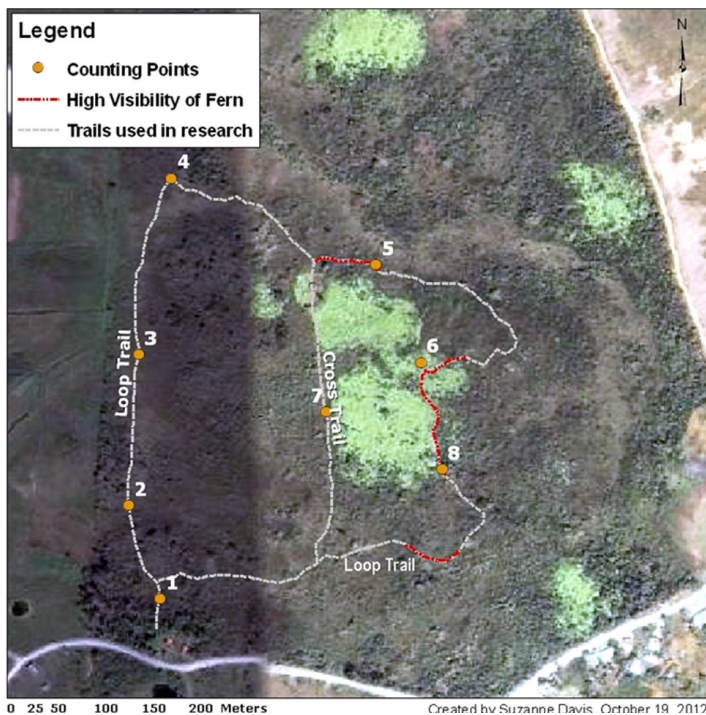


Fig. 1. Study site at Mason River Protected Area, Clarendon Parish, Jamaica, showing bird survey counting points, trails, and visible extent of *Dicranopteris pectinata* (lighter green areas) compared with non-invaded vegetation (darker green). 'High Visibility of Fern' indicates where the fern is established and borders the trail as of 2012.



Fig. 2. Examples of Loop Trail, Mason River Protected Area, Clarendon Parish, Jamaica, (a) non-invaded and (b) invaded by *Dicranopteris pectinata*.

International, Inc., Olathe, KS, USA) and ArcGIS version 9.3 (Environmental Systems Research Institute, Redlands, CA, USA). Note was made of where the fern bordered the Loop Trail and these distances were mapped.

With regards to analysis of the extent of the fern's invasion, the focus was Loop Trail, where the majority of biological features of interest can be seen during tours. First, the length of Loop Trail was estimated using the Measure Tool in ArcMap version 9.3. Second, the lengths of the three extents of invaded habitat along the Loop Trail (Fig. 1) were also estimated using the Measure Tool. Finally, the total length and percentage of invaded Loop Trail was calculated from these three lengths.

Point counts of native and migrant species were conducted to determine bird species richness and composition. A total of eight point count locations were established along the Loop Trail, with four locations in each of the fern-invaded and non-invaded habitats (Fig. 2). Each point was separated by at least 100 m. Ground truthing of the satellite image revealed that over the eight-year period (2005–2012), the fern had spread and established itself on either side of the Loop and Cross Trails (see Fig. 1, points 5, 7, and between 6 and 8). The fern-invaded habitat of point 7 differed from the other fern-invaded locations due to the presence of an experimental plot on the west side of Cross Trail. *D. pectinata* had been removed from this plot in 2001 and 2002 by the Botany Department of NHMJ as part of a study investigating effective ways of controlling the fern. Point 7 was included to observe which birds were using this area, which included low regenerating plant cover.

I recorded bird observations by sight and sound using two unlimited distance point counts conducted on 15 March 2012 and 26 April 2012, between 0730 and 1100. Care was taken not to count the same individuals more than once during a 10-min counting period. Due to the low visibility through the dense vegetation for most locations, I made 'pishing' sounds to attract any cryptic species during the last minute of counting. Species seen en route to counting locations were also noted. Total bird species richness was calculated for fern-invaded and non-invaded habitats along Loop Trail.

The 2012 species list was compared with a baseline species list for the Loop Trail which was extracted from point counts and casual observations in the 2000–2001 survey of MRPA. In the 2000–2001 survey, 10 counting points were set up along Loop Trail. Birds were also detected by sight and sound in 10-min unlimited distance point counts, with morning counts occurring between sunrise and 1030. However, during the first 6 min of the count, a playback technique was employed using 30-sec recordings of Northern Parula (*Setophaga americana*), American Redstart (*Setophaga ruticilla*), and Northern Waterthrush (*Parkesia noveboracensis*). The playback technique did not markedly improve the detection of the three species, which tended to be quiet or cryptic in their movements, and so was not used in the 2012 counts.

Due to logistic and budgetary constraints, less counting effort was spent on the 2012 survey compared to the six morning and afternoon counts of the 2000–2001 survey. On the other hand, more counting locations (four additional) for invaded habitat were set up in this study compared to only one in the previous survey, facilitated by a greater fern-invaded area. Consequently, little significance can be attached to the absolute number of bird species and of individuals in this preliminary survey. Greater attention was given to general patterns in this analysis, which may serve as a guide for designing more comprehensive studies of the impact of *D. pectinata* on bird communities.

In 2001, prior to the recorded spread of *D. pectinata* along Loop Trail, of the total 31 bird species detected along the trail, 23 of these were residents and 8 were migrants (Davis 2003). Of interest is whether any change occurred in the species diversity of resident and of migrant birds along the trail with the invasion of the fern. A Chi-square test was applied to determine if species richness of resident relative to migrant species detected along Loop Trail for both survey periods was statistically different. The null hypothesis for the Chi-square test was: the relative proportion of resident species to migrant species along Loop Trail was the same for the two survey periods. The alternative hypothesis was: the relative proportion of resident species to migrant species along Loop Trail was different for the two survey periods.

Results

Since I conducted the avifauna survey in 2000–2001, there has been a noticeable increase in the occurrence of the fern along the Loop Trail. The fern is primarily on the eastern side of the trail, while the tendency for the fern to be absent from the western and more flood-prone side of the Trail has continued. From the time the satellite image was taken in 2005, apparently there has been invasion by the fern along the southeastern portion of the trail (Fig. 1) and an increase in the fern along the northern portion of the trail. The lengths of the fern-invaded Loop Trail were estimated at 169.3 m, 72.7 m, and 64.0 m, for a total fern-invaded length of 306 m. With the total length of Loop Trail estimated at 1.61 km, 19% of the trail has been invaded by *D. pectinata*. No attempt was made in this study to assess the area of the *D. pectinata* patches adjacent to or intercepted by the Loop Trail. However, my observations indicated that at a minimum the fern has increased in areal extent in the vicinity of point count location 5 and south of point count location 8. The two lengths of trail

with high fern visibility near these locations have a total length of 136.7 m. These invasions indicate that over at least an 8-yr period (2005–2012), the total length of fern-invaded trail increased by an estimated 81% of the previously fern-invaded trail length of 169.3 m. In other words, since 2005 *D. pectinata* has almost doubled in its total length along the trail.

I recorded 17 species of birds across two point counts during two days of fieldwork (Table 1). These included 4 endemic species, 8 other resident species, 3 winter migrants, and 2 summer migrants. At the fern-invaded point count locations (5, 6, 7, and 8), a total of 9 species were detected. The remaining non-invaded locations revealed 15 species. Overall, fewer bird species occurred in fern-invaded habitat than in non-invaded habitat. The total number of resident and migrant species in 2012 was 12 and 5, and in the 2000–2001 period was 23 and 8. My observations revealed that since the spread of the invasive fern no significant change has occurred in the relative proportions of resident and migrant species detected along Loop Trail ($\chi^2 = 0.07$, $df = 1$, $p > 0.05$).

Of particular note is the lower number of endemic species in fern-invaded trail habitat. A total of 4 endemic species were detected along Loop Trail in 2012. Only 2 species, Jamaican Euphonia (*Euphonia jamaica*) and Red-billed Streamertail (*Trochilus polytmus polytmus*), were detected in the fern-invaded habitats. Similarly for winter migrants, of the 3 warblers detected along Loop Trail in this study, only Black-throated Blue Warbler (*Setophaga caerulescens*) was repeatedly seen in fern-invaded habitat. With reference to relative abundance (Table 2), some of the more abundant species on the Loop Trail such as Vervain Hummingbird (*Mellisuga minima*), Black-whiskered Vireo (*Vireo altiloquus*), Gray Kingbird (*Tyrannus dominicensis*), and Northern Mockingbird (*Mimus polyglottos*) were detected in invaded trail habitat. Notably, Vervain Hummingbird was repeatedly observed where there was at least one tree or bamboo on which it could perch.

At the four invaded point count locations, I recorded lower numbers of bird species and individuals where the dominance of *D. pectinata* was greater. I conservatively estimated by eye that the fern cover at point 6 was ~85%. At point 7 on the east side of Cross Trail, the remnant native vegetation was interspersed between the high spread of the invasive fern. On the west side of the trail, the plot that had previously been cleared of *D. pectinata* in 2001 and 2002 by NHMJ and left bare, now had regenerating vegetation comprising mainly grasses and ferns of 0.5 m or less in height, as well as a few shrubs and young trees. Beyond the boundary of the plot was more *D. pectinata*. Only two bird species were recorded for these two bird survey counting points: Black-whiskered Vireo and Red-billed Streamertail for point 6, and Vervain Hummingbird and Gray Kingbird for point 7. However, at points 5 and 8, which had mixed vegetation cover with noticeably more melastomes and trees, I recorded five and six species, respectively. Additionally, I detected Yellow-faced Grassquit (*Tiaris olivaceus*) along Loop Trail where there was intermittent *D. pectinata*, between invaded points 7 and 8. This section of the trail had a greater presence of mature grasses and shrubs than point 7, which may have accounted for the grassquit's occurrence.

Table 1. Bird species counted and casually detected in 2000–2001 and 2012 surveys on Loop Trail, Mason River Protected Area, Clarendon Parish, Jamaica.

Species Detected Along the Loop Trail (2000–2001)	No. of Birds Detected in 2012			
	Non-Invaded	Fern-Invaded	En Route	Total
White-crowned Pigeon (<i>Patagioenas leucocephala</i>) ^a				
Ruddy Quail-Dove (<i>Geotrygon montana</i>)	2			2
White-winged Dove (<i>Zenaida asiatica</i>)		1		1
Jamaican Mango (<i>Anthracothorax mango</i>) ^b	1		1	2
Vervain Hummingbird (<i>Mellisuga minima</i>)	6	5	1	12
Red-billed Streamertail (<i>Trochilus p. polytmus</i>) ^b	3	1		4
Jamaican Tody (<i>Todus todus</i>) ^{a,b}				
Olive-throated Parakeet (<i>Eupsittula nana</i>) ^a				
Smooth-billed Ani (<i>Crotophaga ani</i>) ^a				
Jamaican Elaenia (<i>Myopagis cotta</i>) ^{a,b}				
Greater Antillean Elaenia (<i>Elaenia fallax</i>) ^a				
Sad Flycatcher (<i>Myiarchus barbirostris</i>) ^a				
Gray Kingbird (<i>Tyrannus dominicensis</i>)	3	4	1	8
Loggerhead Kingbird (<i>Tyrannus caudifasciatus</i>)	3			3
Black-whiskered Vireo (<i>Vireo altiloquus</i>)	1	1	3	5
Jamaican Crow (<i>Corvus jamaicensis</i>) ^b	1			1
Rufous-throated Solitaire (<i>Myadestes genibarbis</i>) ^a				
Northern Mockingbird (<i>Mimus polyglottos</i>)		3	2	5
Jamaican Euphonia (<i>Euphonia jamaica</i>) ^b	2	1		3
European Starling (<i>Sturnus vulgaris</i>) ^a				
Connecticut Warbler (<i>Oporornis agilis</i>) ^a				
Common Yellowthroat (<i>Geothlypis trichas</i>)	1			1
American Redstart (<i>Setophaga ruticilla</i>) ^a				
Black-throated Blue Warbler (<i>Setophaga caerulescens</i>)	2	4		6
Palm Warbler (<i>Setophaga palmarum</i>) ^a				
Prairie Warbler (<i>Setophaga bicolor</i>)	1			1
Banaquit (<i>Coereba flaveola</i>)	2	3		5
Yellow-faced Grassquit (<i>Tiaris olivaceus</i>)	3		1	4
Black-faced Grassquit (<i>Tiaris bicolor</i>)	2			2
Orangequit (<i>Euneornis campestris</i>) ^{a,b}				
Yellow-shouldered Grassquit (<i>Loxipasser anoxanthus</i>) ^{a,b}				
TOTAL NO. OF SPECIES	15	9	6	17

^a Where there are no detection values for species indicates that these species were detected on Loop Trail in 2000–2001 but not in 2012. Species listed were detected by both point counts and casual observations.

^b = endemic species

Discussion

The largest patch of invasive fern seems to be posing the greatest threat to plant and animal habitats along and close to the Loop Trail. Much of the fern in this large patch is enclosed within the eastern side of the loop but has gradually been spreading beyond the trail over at least an 8-yr period (Fig. 1). It is noteworthy that Google Earth has four historical images for Mason River Protected Area dated 2004, 2005, 2015, and 2017. A comparison of Google Earth satellite imagery for the years 2004 and 2017 not only confirms the continuing invasion of the fern but also clearly shows its worrisome spread in areas beyond the trails (Fig. 3). If the spread of the fern is not thwarted, it is likely that current plant diversity will eventually be lost as more native species are replaced by invasive fern thicket and only a few persistent tree species remain. None of the berry-bearing me-

lastomes and seed-bearing grasses that are major food sources for many Jamaican birds have survived the invasion of *D. pectinata*. Therefore, it is likely that as the fern spreads, fewer of the fruit- and seed-eating bird species will find these areas of MRPA a hospitable feeding area.

The overall pattern of fewer bird species occurring in fern-invaded habitat than in non-invaded habitat was similar for both the 2000–2001 and 2012 surveys (Table 1). During the earlier survey, I recorded a total of 31 species overall and in the non-invaded habitat, with only 10 species recorded for fern-invaded habitat. In the later survey, I recorded a total of 17 species overall, with 15 species in the non-invaded habitat and only 9 species recorded for fern-invaded habitat. Of particular note is the lower number of endemic and migrant species in fern-invaded trail

Table 2. Total number of birds counted and the relative abundances in 2000–2001 and 2012 surveys on Loop Trail, Mason River Protected Area, Clarendon Parish, Jamaica.

Species counted along the Loop Trail	2000–2001 (6 counts)		2012 (2 counts)	
	No. of birds	Relative Abundance	No. of birds	Relative Abundance
White-crowned Pigeon (<i>Patagioenas leucocephala</i>) ^a	9	1.5		
Ruddy Quail-Dove (<i>Geotrygon montana</i>)			2	1
White-winged Dove (<i>Zenaida asiatica</i>)	1	0.17	1	0.5
Jamaican Mango (<i>Anthracothorax mango</i>) ^b			2	1
Vervain Hummingbird (<i>Mellisuga minima</i>)	43	7.17	12	6
Red-billed Streamertail (<i>Trochilus p. polytmus</i>) ^b	1	0.67	4	2
Jamaican Todyb (<i>Todus todus</i>) ^a	2	0.33		
Olive-throated Parakeet (<i>Eupsittula nana</i>) ^a	12	2		
Smooth-billed Ani (<i>Crotophaga ani</i>) ^a	3	0.5		
Gray Kingbird (<i>Tyrannus dominicensis</i>)	15	2.5	8	4
Loggerhead Kingbird (<i>Tyrannus caudifasciatus</i>)	6	1	3	1.5
Black-whiskered Vireo (<i>Vireo altiloquus</i>)	24	4	5	2.5
Jamaican Crow (<i>Corvus jamaicensis</i>) ^b	5	0.83	1	0.5
Rufous-throated Solitaire (<i>Myadestes genibarbis</i>) ^a	4	0.67		
Northern Mockingbird (<i>Mimus polyglottos</i>)	14	2.33	5	2.5
Jamaican Euphonia (<i>Euphonia Jamaica</i>) ^b	1	0.17	3	1.5
Common Yellowthroat (<i>Geothlypis trichas</i>)	4	0.67	1	0.5
American Redstart (<i>Setophaga ruticilla</i>) ^a	1	0.17		
Black-throated Blue Warbler (<i>Setophaga caerulescens</i>)	4	0.67	6	3
Prairie Warbler (<i>Setophaga bicolor</i>)	1	0.17	1	0.5
Banaquit (<i>Coereba flaveola</i>)	6	1	5	2.5
Yellow-faced Grassquit (<i>Tiaris olivaceus</i>)	23	3.83	4	2
Black-faced Grassquit (<i>Tiaris bicolor</i>)	16	2.67	2	1
Orangequit (<i>Euneornis campestris</i>) ^{a,b}	1	0.17		
Yellow-shouldered Grassquit (<i>Loxipasser anoxanthus</i>) ^{a,b}	4	0.67		

^a Where there are no detection values for species indicates that these species were counted on Loop Trail in 2000–2001 but not in 2012.

^b = endemic species



Imagery date: November 17th 2004
Source: Google Earth
Created by Suzanne Davis, February 1 2018

Fig. 3. Overall spread of *Dicranopteris pectinata* at Mason River Protected Area, Clarendon Parish, Jamaica over a 12-yr period including areas beyond the Loop and Cross Trails.

habitat for both survey periods. Common to both survey periods is the occurrence of five bird species in fern-invaded habitat: the summer migrants Black-whiskered Vireo and Gray Kingbird, and the residents Jamaican Euphonia, Northern Mockingbird, and Vervain Hummingbird. These species are known to use scattered trees or can be seen in vegetation at various heights. They are also primarily insectivores or have a mixed diet of fruit and insects. Notably, endemic species were not among the commonly or more abundantly occurring birds.

With reference to the more extensive 2000–2001 survey, it is likely that limitations of the 2012 point count method — fewer counts, made only in the morning, and with no complementary method (e.g., mist-netting, tape playbacks) — resulted in a few bird species going undetected. However, it is important to note that seasonal occurrence displayed by some species is also a likely contributor to the lower species richness in this study, compared to the more extensive 2000–2001 survey. The time of the 2012 survey (March and April) may have precluded the detection of at least Rufous-throated Solitaire (*Myadestes genibarbis*), which usually migrates to upland wooded areas

to breed from April to November (Downer and Sutton 1990, Haynes-Sutton *et al.* 2009); Olive-throated Parakeet (*Eupsittula nana*), whose abundance peaks with the fruiting of another invasive plant, strawberry guava (*Psidium cattleianum*), usually during September to December; and European Starling (*Sturnus vulgaris*), which is intermittently present in the area (Downer and Sutton 1990).

The findings of this study have implications for two categories of ecosystem services known as supporting and cultural ecosystem services. Supporting services that include nutrient cycling, photosynthesis, and soil formation are essential to maintaining species diversity, especially among primary producers. It is a fair assumption that in the fern-invaded habitats the blockage of sunlight by the fern thickets, the observed persistence of fern leaf litter, and prevention of colonization by other plants have changed the ecosystem's capacity to provide supporting services. Humans indirectly benefit from supporting services, as these services are essential to maintaining biodiversity. It is the biodiversity of MRPA that forms the basis for the educational and recreational ecosystem services (i.e., cultural ecosystem services) that are received through nature walks and guided tours. Nearly half of the features of interest pointed out during a NHMJ guided tour are plants that are absent from fern-invaded habitats. Highlighting the importance of bird conservation and relating birds to natural heritage during a tour will become more challenging as evidence of bird diversity becomes less visible along the Loop Trail.

Conclusions and Recommendations

D. pectinata is concentrated on the eastern side of Loop Trail. The invasion is evident along three discontinuous lengths of the trail, totaling just under 20% of the trail. The low species richness of birds occurring in fern-invaded habitats during both survey periods (2000–2001 and 2012) indicates that the fern may be a threat to bird diversity as well as birdwatching opportunities. Referring to the list of 31 species of birds that may be observed along Loop Trail, the species composition of the MRPA may be regarded as assemblages of nectar-, seed-, berry-, and insect-eaters. The occurrence in fern-invaded habitats of one or two representatives from the feeding assemblages of nectar-, seed- and berry-feeders contrasts with the higher number of these feeders occurring in the non-invaded habitats. Further expansion of the fern along Loop Trail, along with overall expansion of the size of the fern patches, could eventually result in species-poor bird communities.

Further fern invasion along the trail should be expected, unless the fern is effectively controlled. Without an appropriate management intervention, the fern will continue to spread and eventually become the dominant vegetation at the expense of native plants, except for a few trees. In other words, the scrub savanna ecosystem will be displaced. In the Management Plan for MRPA 2014–2019, a specific objective of the Biodiversity Conservation Programme is “to reduce cover of the Vampire Fern by 60% in five years.” The aforementioned experimental plot on the west side of Cross Trail was established by the NHMJ where they found that manual uprooting of the fern, though very labor intensive and costly, was the most effective approach to controlling the fern. Recognizing past efforts of the NHMJ to control

D. pectinata, higher priority must be placed on controlling the spread of this invasive fern as part of an effective conservation program for the MRPA.

The nature walk experience offered by the NHMJ is being diminished by *D. pectinata* as it 1) reduces plant diversity, 2) changes bird habitats, and 3) makes birdwatching unattractive due to the presence of fewer common bird species. Additionally, the thicket formed by the fern usually decreases visibility of the already dense native vegetation, and therefore lowers chances of successfully sighting birds in the undergrowth. The consequent reduction in the cultural ecosystem services, more specifically the educational and recreational experiences and opportunities, will diminish the value of the nature tour offered by the NHMJ. By controlling the spread of the invasive fern, the NHMJ will protect the cultural ecosystem services provided by MRPA and ultimately the NHMJ's nature tour product.

This study is a starting point for more in-depth research on the impact of the native invasive fern *D. pectinata* on the bird communities of the MRPA. A longer point count period coupled with mist-netting to sample migratory and resident birds would strengthen survey methods. In accordance with the Management Plan, collaborative grant-funded research projects with a conservation scientist or entity would be an option to fund the necessary research. Furthermore, the MRPA offers an opportunity to gain a better understanding of a rare ecosystem that has been impacted by a native invasive fern and to provide a case study on the management of the fern, and protection of the biodiversity that it threatens, in other protected areas in the Caribbean.

Acknowledgments

Thank you to the former Warden (Leando Notice), Catherine Levy, and Marlon Beale from BirdLife Jamaica and former Peace Corps Volunteer Christopher Carew for their interest and participation in the fieldwork for the 2000–2001 survey. Thanks to current Wardens Marcel Bruce and Christopher Daley for their interest and participation in the fieldwork for the 2012 survey. Thanks to my colleagues at the Natural History Museum of Jamaica who provided or helped to locate useful information for surveys and for this manuscript. Much appreciation for comments received from James W. Wiley on an earlier draft of my manuscript.

Author Information

Natural History Museum of Jamaica, Institute of Jamaica, 10–16 East Street, Kingston, Jamaica; e-mail: sdavis@nhmj-joj.org.jm

Literature Cited

- Davis, S. 2003. A survey and inventory of the avifauna of the Mason River Game Sanctuary, Clarendon, Jamaica. Technical Report to the Environmental Foundation of Jamaica, Kingston, Jamaica.
- Downer, A., and R. Sutton. 1990. Birds of Jamaica. Cambridge University Press, Cambridge, United Kingdom.
- Haynes-Sutton, A., A. Downer, and R. Sutton. 2009. A photographic guide to the birds of Jamaica. Christopher Helm, London, United Kingdom.
- Millenium Ecosystem Assessment. 2005. Ecosystems and Human Well-being: Synthesis. Island Press, Washington D.C.
- Proctor, G.R. 1985. Ferns of Jamaica: a guide to the Pteridophytes. British Museum (Natural History), London, United Kingdom.

- Proctor, G. 1970. Mason River Field Station. *Jamaica Journal* 4(2):29–33.
- Shiels, A.B., and L.R. Walker. 2003. Bird Perches Increase Forest Seeds on Puerto Rican Landslides. *Restoration Ecology* 11(4):457–465.
- Slocum, M.G., T.M. Aide, J.K. Zimmerman, and L. Navarro. 2006. A strategy for restoration of montane forest in anthropogenic fern thickets in the Dominican Republic. *Restoration Ecology* 14(4):526–536.
- Smith, R.W. 1969. The birds at Mason River, Clarendon, in May. *Gosse Bird Club Broadsheet* 13:16–17.
- Weck, S.G. 1970. The vegetation of Mason River Field Station—an induced, upland scrub-savanna in Jamaica. Unpublished Master of Arts thesis, Department of Botany, Duke University, North Carolina, USA.
- White, M.N. 1991. Reconnaissance survey of the hydrology of the Mason River Field Station. Hydrology Consultants Limited, Kingston, Jamaica.
- Zhao, J., S. Wan, Z. Li, Y. Shao, G. Xu, Z. Liu, L. Zhou and S. Fu. 2012. *Dicranopteris*-dominated understory as a major driver of intensive forest ecosystem in humid subtropical and tropical region. *Soil Biology & Biochemistry* 49:78–87.

Cite this article as:

Davis, S.M.C. 2019. Impact of an invasive fern (*Dicranopteris pectinata*) on bird diversity and birdwatching in a Jamaican Ramsar site. *Journal of Caribbean Ornithology* 32:57-64. <https://doi.org/10.55431/jco.2019.32.57-64>