

Is the exotic Brazilian pepper *Schinus terebinthifolius* a threat to mangrove ecosystems in Florida?

Melinda J. Donnelly and Linda J. Walters
Department of Biology, University of Central Florida, Orlando, FL 32816 USA

Introduction

Mangrove ecosystems are critical to Florida, providing economic and ecological resources to humans and estuarine organisms. In Florida's estuaries, mangrove ecosystems have suffered significant losses due to natural and human disturbances; these disturbances potentially leave mangrove communities vulnerable to invasion by the opportunistic exotic, *Schinus terebinthifolius* (Brazilian pepper). Prior experiments have suggested that Brazilian pepper is unable to survive under marine conditions (soil salinity greater than 5 ppt) and pose no long-term threat to mangroves. However, this contradicts field observations where Brazilian pepper is found growing in the intertidal zone alongside native mangroves, including *Rhizophora mangle* (red mangrove), *Avicennia germinans* (black mangrove) and *Laguncularia racemosa* (white mangrove). The purpose of this study is to examine life-history characteristics of Brazilian pepper that enable this exotic to invade mangrove ecosystems.

Does Brazilian pepper grow in soil salinities greater than 5 ppt?

Methods- At 10 sites, ten parallel 0.25 m² quadrats (3 m apart) were marked at 0, 10 and 20 meters above the intertidal region. Quadrats were visited monthly (start: 8/04) and all plants were identified and recorded. Soil samples were taken from the quadrats (start: 11/04) to determine if Brazilian pepper grows in soil salinities greater than 5 ppt.

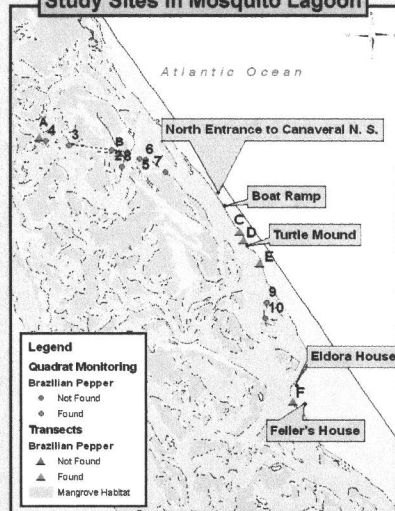
Site #	Salinity Range (ppt)	Mean Salinity (± SD) (ppt)	Mean # Brazilian Pepper/ m ² (± SD)
November			
1	11.2-16.8	14.2 (± 2.4)	0
2	2.2-13.4	7.5 (± 2.7)	2.4 (± 0.5)
3	1.1-9.5	5.9 (± 2.0)	0.2 (± 0.05)
4	7.3-15.1	10.0 (± 2.7)	0.2 (± 0.05)
5	7.3-11.8	9.4 (± 1.4)	0.4 (± 0.2)
6	1.1-8.4	5.7 (± 2.8)	0.8 (± 0.3)
7	5.1-11.6	10.1 (± 4.4)	0
8	6.7-16.8	11.9 (± 2.8)	0
9	5.6-11.2	9.1 (± 1.5)	1.2 (± 0.3)
10	10.1-19.8	15.6 (± 2.6)	0
December			
1	6.2-12.3	9.5 (± 2.4)	0
2	2.8-10.6	5.8 (± 1.8)	2.4 (± 0.4)
3	1.6-6.7	3.6 (± 1.8)	0.2 (± 0.05)
4	1.7-8.4	5.4 (± 2.4)	0.1 (± 0.05)
5	1.7-21.0	9.3 (± 8.1)	0.1 (± 0.05)
6	3.9-8.4	4.0 (± 2.6)	1.4 (± 0.6)
7	3.9-16.2	10.8 (± 3.4)	0
8	7.8-18.5	11.5 (± 6.0)	0
9	6.1-13.4	8.4 (± 3.9)	1.0 (± 0.3)
10	5.0-19.6	14.1 (± 5.2)	0



Questions

1. Can Brazilian pepper seeds disperse in salt water?
2. Is Brazilian pepper growing in soil with salinities greater than 5 ppt?
3. Does Brazilian pepper alter species richness and abundance when present in this mangrove ecosystem?

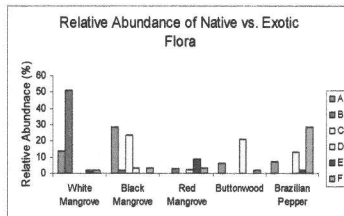
Study Sites in Mosquito Lagoon



Does Brazilian pepper alter species richness and abundance in the mangrove ecosystem?

Methods- Two line transects (30 m) from the lagoon shoreline into the mangrove-upland ecotone were surveyed at 6 sites within Mosquito Lagoon. Plants were recorded at 1 m intervals to estimate species richness and abundance of floral species in the presence/absence of Brazilian pepper.

Site	Species Richness	Relative Abundance of Brazilian Pepper
A	14	7.4%
B	5	0%
C	14	28.5%
D	11	13.3%
E	13	2.2%
F	4	0%

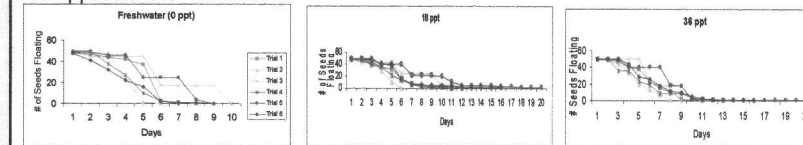


Can Brazilian pepper seeds disperse in salt water?

Water dispersal requires buoyant seeds. The length of time seeds remain buoyant represents the maximum time a seed can disperse in water to a new habitat.

Methods- 50 Brazilian pepper seeds were placed in 5-gallon buckets with 0, 15, or 30 ppt saltwater to determine length of time the seeds retained buoyancy.

Results- Initially, seeds floated at all salinities. The number of days seeds remained buoyant was significantly greater for seeds in the 36 ppt saltwater than the other treatments ($p < 0.05$). The mean number of days for all seeds to sink was 14 (± 4.3 SD) in 36 ppt saltwater.

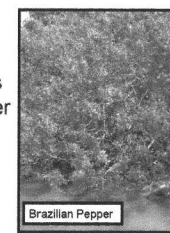


Methods- 30 seeds and 15 seed clusters were released into Mosquito Lagoon and the distance traveled was measured after 10 minutes to estimate dispersal rate. This experiment was run in 11/04 and 1/05. Wind speed, water temperature and salinity were also recorded.

	Wind (m/s)	Water Salinity (ppt)	Mean Seed Mass (g) (± SD)	Mean Dispersal Rate (m/s) (± SD)
11/04				
Seeds	1.6	34	0.01 (.03)	0.04 (.01)
Clusters	1.6	34	0.70 (.33)	0.04 (.01)
1/05				
Seeds	0.9	35	0.01 (.04)	0.01 (.01)
Clusters	0.9	35	0.60 (.30)	0.02 (.01)

Conclusions

1. The results from the buoyancy and dispersal trials suggest that at 36 ppt a Brazilian pepper seed can disperse between 7.3 and 44.3 km.
2. Brazilian pepper was found growing in soil salinities from 1.1 to 13.4 ppt. All three species of mangroves were also found growing in these same soil conditions. Higher soil salinities at sites without Brazilian pepper may only support halophytic plants.
3. The mean relative abundance of Brazilian pepper was 8.6% (± 11.1 SD) in intertidal areas of Mosquito Lagoon. Sites with Brazilian pepper had higher species richness than sites without this exotic. However, if Brazilian pepper continues to spread in these areas, species richness will likely decline.



Acknowledgements: This research was supported by National (LW) & Florida Sea Grant (MD & LW) and a UCF Biology Graduate Research Enhancement Award (MD). We would also like to thank Canaveral National Seashore for access to the study site and W. Donnelly, T. Donnelly, B. Anderson, C. Anderson, D. Anderson, J. & J. Stiner M. Boudreaux, P. Quintana-Ascencio and J. Weishampel for their help and support.
For more information: mwdt@bellsouth.net