

Agrochemical Fate in South Florida Ecosystems

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Significant declines in ecosystem health of the Biscayne and Florida Bays have been reported in the past decade and include die-off of sea grass beds, declines in sponge, coral and shellfish populations and development of noxious algal blooms. In South Florida, nearly 20 million pounds of pesticide active ingredients are used in agricultural production and for mosquito control and landscape management. Previous surface water studies have indicated the presence of endosulfan in Florida Bay and atrazine in Lake Okeechobee. Although measured levels were generally low, some adverse ecological impacts were observed. The goal of the current study is to determine the types, amounts, and rates of agricultural pesticide inputs to South Florida sensitive ecosystems so that agricultural practices can be modified to minimize negative effects.

Field sites were established at the Everglades National Park, Adam's Key in Biscayne National Park, and the Tropical Research and Education Center at University of Florida in Homestead, Florida. Weekly air samples using glass fiber filters and polyurethane foam sorbent in a high volume air sampler. Event based rain samples were collected, filtered and processed using solid phase extraction in an automated system. Surface water collection trips were conducted four times during the growing seasons (October – March). All air, rain, and water extracts were analyzed by GC-MS (NCI, EI). Rain and water extracts were also analyzed by LC-MS for method validation and for degradation products. The 60 target compounds included the top 20 active ingredients applied by South Florida growers and major degradation products.

Endosulfan concentrations were highest in water samples collected near agricultural activity (max= 0.07 µg/L). Concentrations in rain were significantly higher, ranging from 10 - 4000 µg/L, with short intense deposition events during the growing season. Endosulfan was consistently detected year round in air samples, with maximum levels (90 ng/m³) detected in January. Atrazine was detected at nearly every water station with concentrations ranging from 0.005-0.095 µg/L; rain results show maximum concentrations (0.64 µg/L) while concentrations in air were low and inconsistent (0.2-1.4 ng/m³). Chlorpyrifos was detected in water samples in the ag/urban region (max=0.05 µg/L) with much lower concentrations of diazinon (0.004 µg/L). In rain, diazinon and chlorpyrifos were frequently detected at low levels with the highest concentrations during the growing season (max chlorpyrifos=0.004 diazinon=83 µg/L). In air samples, diazinon was present at the highest concentrations during the winter months (max=90 ng/m³) with lower concentrations of chlorpyrifos and malathion detected throughout the year. These results suggest that the environmental conditions in South Florida of frequent precipitation and irrigation, high evapotranspiration, high temperatures, low organic carbon soils and shallow ground water are conducive to pumping pesticides into the atmosphere where they can be transported rapidly to non-target ecosystems.