

# DIOXINS, FURANS AND DIOXIN LIKE PCB LEVELS IN AGRICULTURAL AND FOREST SOIL FROM SÃO PAULO STATE, BRAZIL

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## Introduction

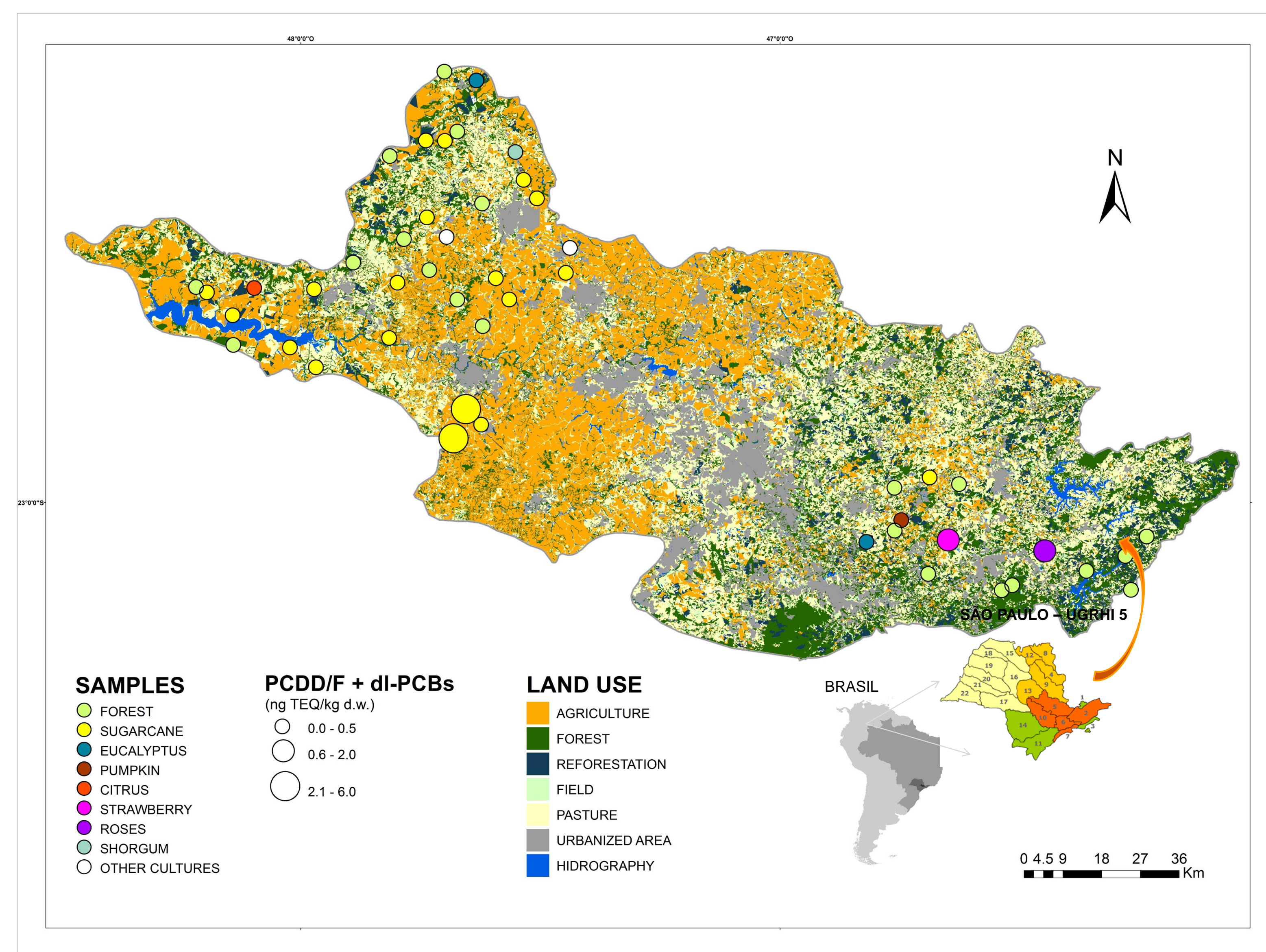
Polychlorinated dibenzo-p-dioxins (PCDD), polychlorinated dibenzofurans (PCDF) and polychlorinated biphenyls (PCB) are present in the environment primarily as a result of human activities. According to the Brazilian Inventory of sources and estimation of emissions of dioxins and furans<sup>1</sup>, the southeast region with a high degree of industrialization and agricultural activity, contributes with 58.8% of emissions of dioxins and furans and São Paulo State is the biggest national contributor for the emissions (28.9%). In Brazil, for the evaluation of soil quality monitoring activities there is a national orientative guideline list that includes inorganic and organic substances, but till now do not include dioxin like compounds. CETESB has just started the study for dioxin like compounds to increase the understanding the level of these compounds in soil and in the future subsidize the establishment of guiding values in São Paulo State and for national guide.

## Materials and Methods

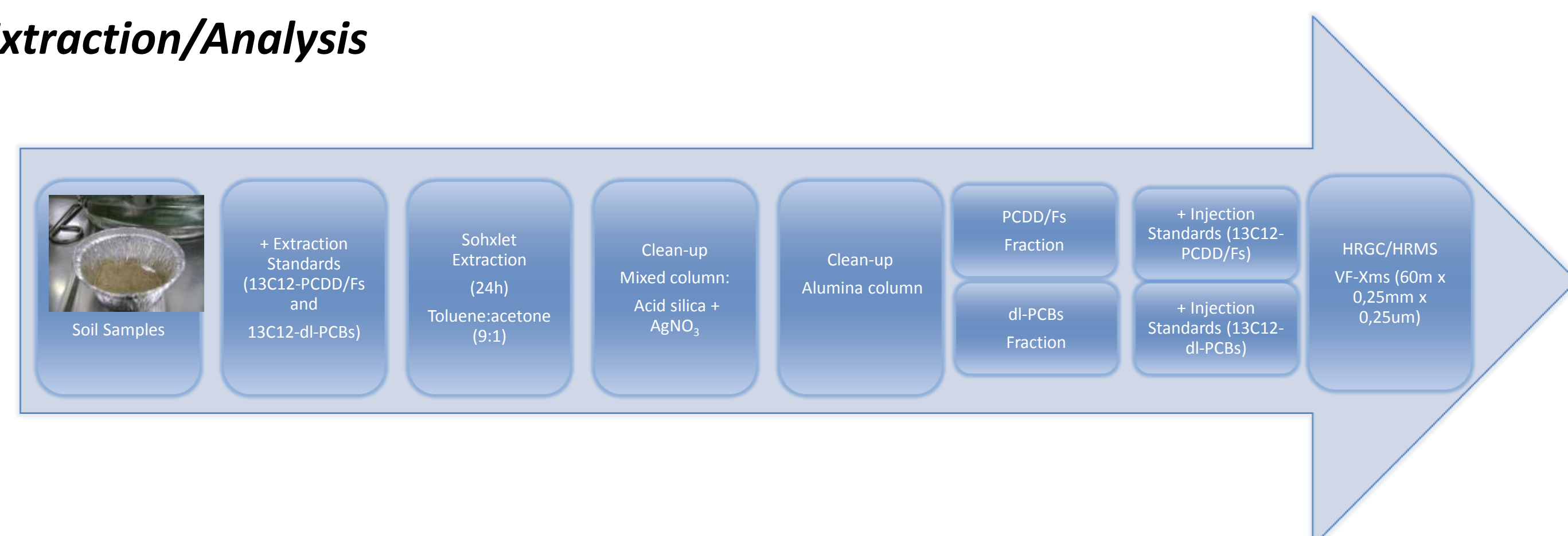
### Sampling Site

The area chosen for the study is one of the 22 Watershed Management Units of São Paulo State (UGRHI 5) and consists of basins of Piracicaba (11,320km<sup>2</sup>), Capivari (1,570km<sup>2</sup>) and Jundiá (1,150km<sup>2</sup>) rivers. The basin of these rivers covers 57 municipalities and comprises over 12% of the state population. Traditionally agricultural (mainly sugarcane and coffee plantations), the region has become in recent decades a major industrial centers in the country. The total of 49 composite samples were collected during 2011 and 2012. Two types of land use were considered for this study: agricultural and forest fragments.

Figure 1 – Sampling sites: São Paulo State Watershed Management Unit 5 (UGRHI 5)



### Extraction/Analysis



## Results and Discussion

The PCDD/F results (Table 1, 2 and 3) are similar or slightly above the Amazon basin<sup>6</sup> soils and very similar or even below other countries (Austria, Germany, Ireland, Luxemburg)<sup>7</sup> forest soils. According to the Brazilian Inventory of sources and estimation of emissions of dioxins and furans<sup>1</sup>, sources of emissions to soil identified are fires and burning in open air (54%) and biomass burning in open air (46%). The deposition from the air can be one of sources of dioxin like compounds found in the samples. The samples from sugarcane culture with higher concentration levels (n=2) indicate that it can be due to the application of residue from sugarcane industry but it was not possible to confirm.

Table1 – Concentration of PCDD/F+dl-PCBs in soil samples (ng TEQ WHO<sub>05</sub>/kg d.w.)

Land use/culture	TEQ <sub>ΣPCDD/F+dl-PCB</sub> (<LOD = 0)	TEQ <sub>ΣPCDD/F+dl-PCB</sub> (<LOD = LOD)	TEQ <sub>ΣPCDD/F+dl-PCB</sub> (<LOQ = LOQ)
Forest fragments (n=21) [min - max]	0.11 [0.001 - 0.37]	0.89 [0.47 - 1.45]	2.50 [1.40 - 4.08]
Sugarcane (n=18) [min - max]	0.09 [0.0008 - 0.42]	0.81 [0.07 - 1.52]	2.28 [1.36 - 3.72]
Sugarcane (n=2)* [min - max]	4.79 [3.58 - 6.00]	6.07 [4.64 - 7.49]	6.55 [4.85 - 8.24]
Bean (n=1)	0.27	1.28	3.29
Citrus (n=1)	0.005	0.50	1.67
Eucalyptus (n= 2) [min - max]	0.08 [0.01- 0.14]	1.22 [0.82 - 1.62]	3.45 [2.52 - 4.39]
Pumpkin (n=1)	0.03	1.16	3.35
Roses (n=1)	1.43	3.09	5.76
Sorghum (n=1)	0.001	0.80	2.62
Strawberry (n=1)	1.67	2.65	4.79

Table2 – Concentration profile of PCDD/F and dl-PCBs in agricultural /forest fragments soils (ng TEQ WHO<sub>05</sub>/kg d.w.), considering results <LOD=zero for TEQ calculation

Concentration (ng TEQ/kg)	Forest fragments (n=21)	Sugarcane (n=18)	Sugarcane* (n=2)	Eucalyptus (n=2)
ΣPCDD (mean) [min - max]	0.07 [0.0008 - 0.29]	0.06 [0.0006 - 0.37]	2.90 [1.63 - 4.17]	0.02 [0.010 - 0.022]
ΣPCDF (mean) [min - max]	0.01 [0.00 - 0.17]	0.017 [0.00 - 0.13]	1.82 [1.82 - 1.82]	0.00
ΣPCDD/F (mean) [min - max]	0.08 [0.0008 - 0.30]	0.08 [0.0006 - 0.37]	4.72 [3.46 - 6.00]	0.02 [0.010 - 0.022]
Σdl-PCB (mean) [min - max]	0.03 [0.0002 - 0.13]	0.01 [0.0001 - 0.10]	0.06 [0.005 - 0.12]	0.06 [0.0008 - 0.12]
ΣPCDD/F+dl-PCB (mean) [min - max]	0.11 [0.001 - 0.37]	0.09 [0.001 - 0.42]	4.79 [3.58 - 6.00]	0.08 [0.01 - 0.14]

Table 3 – Concentration profile of PCDD, PCDF and dl-PCBs in agricultural soil samples (ng TEQ WHO<sub>05</sub>/kg d.w.), considering results <LOD=zero for TEQ calculation

Concentration (ng TEQ/kg)	Bean	Citrus	Pumpkin	Roses	Sorghum	Strawberry
ΣPCDD	0.03	0.001	0.02	0.89	0.001	1.50
ΣPCDF	0.18	0.004	0.01	0.22	0.000	0.09
ΣPCDD/F	0.21	0.005	0.03	1.12	0.001	1.59
Σdl-PCB	0.07	0.0001	0.0004	0.31	0.0002	0.08
ΣPCDD/F+dl-PCB	0.27	0.005	0.03	1.43	0.001	1.67

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