Deposition

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Modeling

We use the three-parameter logistic model (Equation 1) for fitting dicamba deposition (η g filter^{-1}) with distance from the dicamba treated area.

Equation 1:

$$Y = \frac{d}{(1 + exp[b(logx - loge)]}$$

where Y is the dicamba deposition (g filter^{-1}), x is the distance (m) from the dicamba treated area. in The parameter d is the upper limit (asymptote), b is the slope and the parameter e is the ED50 (effective x that causes 50% reduction in Y).
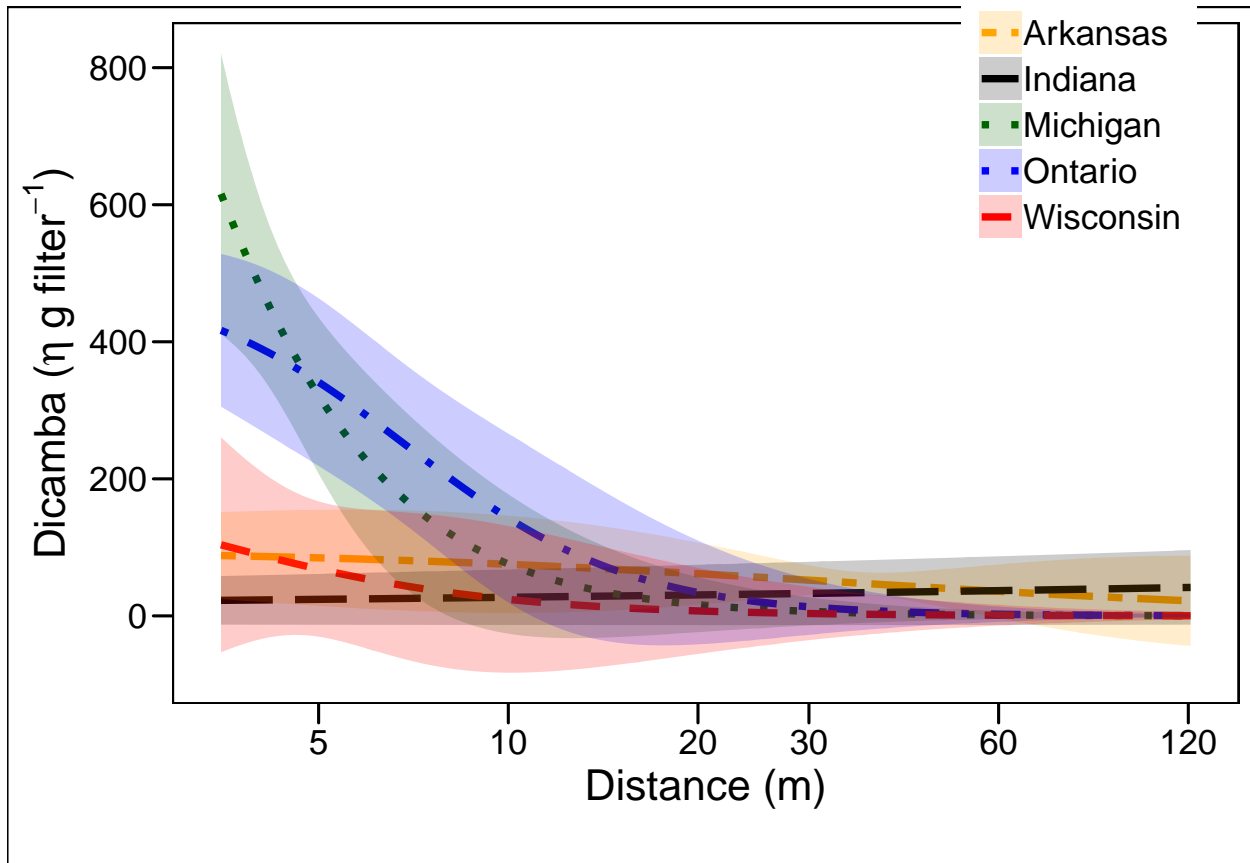
Parameter estimates of Arkansas, Ontario, Indiana, Michigan, and Wisconsin

```
##
## Model fitted: Log-logistic (ED50 as parameter) with lower limit at 0 (3 parms)
##
## Parameter estimates:
##
##                        Estimate  Std. Error     t-value    p-value
## slope:Wisconsin       1.8481e+00  3.0515e+00   6.0560e-01 0.5461715
## slope:Michigan        2.2443e+00  7.9604e-01   2.8193e+00 0.0058345 **
## slope:Indiana        -1.7442e-01  3.4085e-02  -5.1171e+00 1.567e-06 ***
## slope:Ontario         2.4488e+00  1.0358e+00   2.3642e+00 0.0200639 *
## slope:Arkansas        9.9033e-01  1.5904e+00   6.2270e-01 0.5349552
## asymptote:Wisconsin   2.3275e+02  9.9992e+00   2.3277e+01 < 2.2e-16 ***
## asymptote:Michigan    2.4348e+03  1.0000e+01   2.4348e+02 < 2.2e-16 ***
## asymptote:Indiana     1.3841e+03  1.0000e+01   1.3841e+02 < 2.2e-16 ***
## asymptote:Ontario     4.9550e+02  9.9961e+00   4.9569e+01 < 2.2e-16 ***
## asymptote:Arkansas    9.7057e+01  9.9009e+00   9.8029e+00 4.007e-16 ***
## ed50:Wisconsin        3.1107e+00  2.7599e+00   1.1271e+00 0.2624734
## ed50:Michigan         2.1601e+00  5.4261e-01   3.9809e+00 0.0001326 ***
## ed50:Indiana          5.4539e+10  1.0000e+01   5.4539e+09 < 2.2e-16 ***
## ed50:Ontario          6.9109e+00  1.3495e+00   5.1210e+00 1.542e-06 ***
## ed50:Arkansas         3.4909e+01  9.8769e+00   3.5344e+00 0.0006281 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error:
##
##  113.4178 (97 degrees of freedom)
```

ED estimates of Arkansas, Ontario, Indiana, Michigan, and Wisconsin

The distance (m) that dicamba deposition (η g filter^{-1}) is reduced by 20, 50, and 90% of the relative upper limit (asymptote).

```
##
## Estimated effective doses
##
##                   Estimate Std. Error
## e:Arkansas:20   8.6098e+00 1.9867e+01
## e:Arkansas:50   3.4909e+01 9.8769e+00
## e:Arkansas:90   3.2099e+02 1.1337e+03
## e:Indiana:20    1.9272e+07 2.9933e+07
## e:Indiana:50    5.4539e+10 1.0000e+01
## e:Indiana:90    1.6131e+16 3.9711e+16
## e:Michigan:20   1.1647e+00 5.4202e-01
## e:Michigan:50   2.1601e+00 5.4261e-01
## e:Michigan:90   5.7499e+00 7.3886e-01
## e:Ontario:20    3.9235e+00 1.2138e+00
## e:Ontario:50    6.9109e+00 1.3495e+00
## e:Ontario:90    1.6952e+01 7.2281e+00
## e:Wisconsin:20 1.4692e+00 2.9542e+00
## e:Wisconsin:50 3.1107e+00 2.7599e+00
## e:Wisconsin:90 1.0214e+01 1.4124e+01
```

Parameter estimates of Nebraska.

```
##
## Model fitted: Log-logistic (ED50 as parameter) with lower limit at 0 (3 parms)
##
## Parameter estimates:
##
##                        Estimate  Std. Error    t-value   p-value
## slope:Wisconsin      1.8481e+00  3.0515e+00  6.0560e-01 0.5461715
## slope:Michigan       2.2443e+00  7.9604e-01  2.8193e+00 0.0058345 **
## slope:Indiana       -1.7442e-01  3.4085e-02 -5.1171e+00 1.567e-06 ***
## slope:Ontario        2.4488e+00  1.0358e+00  2.3642e+00 0.0200639 *
## slope:Arkansas       9.9033e-01  1.5904e+00  6.2270e-01 0.5349552
## asymptote:Wisconsin  2.3275e+02  9.9992e+00  2.3277e+01 < 2.2e-16 ***
## asymptote:Michigan   2.4348e+03  1.0000e+01  2.4348e+02 < 2.2e-16 ***
## asymptote:Indiana    1.3841e+03  1.0000e+01  1.3841e+02 < 2.2e-16 ***
## asymptote:Ontario    4.9550e+02  9.9961e+00  4.9569e+01 < 2.2e-16 ***
## asymptote:Arkansas   9.7057e+01  9.9009e+00  9.8029e+00 4.007e-16 ***
## ed50:Wisconsin       3.1107e+00  2.7599e+00  1.1271e+00 0.2624734
## ed50:Michigan        2.1601e+00  5.4261e-01  3.9809e+00 0.0001326 ***
## ed50:Indiana         5.4539e+10  1.0000e+01  5.4539e+09 < 2.2e-16 ***
## ed50:Ontario         6.9109e+00  1.3495e+00  5.1210e+00 1.542e-06 ***
## ed50:Arkansas        3.4909e+01  9.8769e+00  3.5344e+00 0.0006281 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error:
##
##  113.4178 (97 degrees of freedom)
```

ED estimates of Nebraska

The distance (m) that dicamba deposition (η g filter^{-1}) is reduced by 20, 50, and 90% of the relative upper limit (asymptote).

```
##
## Estimated effective doses
##
##         Estimate Std. Error
## e:1:20   3.0954     2.3025
## e:1:50   5.5182     2.7462
## e:1:90  13.7961     2.4152

## Scale for 'y' is already present. Adding another scale for 'y', which
## will replace the existing scale.
```