4.2.5 Air quality

The method for determining air quality benefits due to green roofs was an extension of the research results of Currie (2005a, 2005b), which used the UFORE-D model from the USDA Forest Service (Nowak and Crane, 1998) in determining reductions in atmospheric pollutants (0_3, $S0_2$, $N0_2$, C0, PM_{10}) due to the distribution of urban vegetation habitats. The model predicts annual contaminant-deposition rates in response to pollutant concentrations in the air, and parameters reflecting the abundance of various classes of vegetation. Currie assembled the necessary data for developing these parameters in midtown Toronto. For each of 72 monitored plots (of 400 m^2 each), the model's parameters were derived from observations of land cover and land use, assembled from GIS data: tree, shrub and ground vegetation abundance, buildings, low, medium and high residential, commercial, industrial, institutional and open areas (DMTI Spatial 2000; Kenney, 2001). Hourly meteorological and air pollutant concentration measurements (Environment Canada, 1998) for nearby stations (Pearson Buttonville, and Toronto Island Airports) were also collected.

The UFORE-D model develops measures of expected annual contaminant removals and their dollar value. This economic measure is based on work by Murray (1994) in New York State, and represent "the perceived cost to society of pollution emissions based on predicted air pollution consequences to health and the environment" (Currie, 2005a).

To use Currie's results in the current study, these atmospheric-contaminant reductions and their dollar values were related to the surface area taken up by buildings' rooftops. Currie used a study area of 1215.4 ha. Of which 9% of this area was capable of taking a green roof (109.386ha). Her application of the UFORE-D model predicted reductions associated with "grass roofs" as shown in Table 4.4

Table 4.4
Impact on air quality from grass roofs
Reductions in contaminants and monetary impact as shown

	CO	NO_2	O_3	PM_{10}	SO_2	US$
mg per 109.386 ha of green roof area per year	0.35	1.6	3.14	2.17	0.61	43,106

These results were extrapolated over the city as a measure of the air quality improvement expected by green roof adoption, and were calculated first by prorating the available green roof areas per watershed, then summing these for a Toronto-wide total.

The economic value of the air quality benefits related to green roofs resulting from reduction in CO, NO_2, O_3, PM_{10}, SO_2 for 100% green roof implementation in the City of Toronto would be $394.07 per hectare of green roof x 4984 hectares = US$1,970,000. The equivalent in Canadian dollars based on 2004 exchange rates adjusted for purchasing power parity would be approximately $2,500,000 per year (OECD 2005).