Brownfield Development:
A Comparison of North American and British Approaches

Paper presented at the European Urban Research Association Conference 'The Vital City' held at the University of Glasgow, 12 – 14 September 2007

David Adams, University of Glasgow, UK[1] and Chris De Sousa, University of Wisconsin-Milwaukee, USA[2]

Abstract

Over the past 30 to 40 years, urban change and deindustrialisation in advanced economies have created a legacy of vacant and derelict land that is increasingly seen as a development opportunity rather than planning problem. This paper investigates how the shared challenge of bringing such brownfields back into productive use has been interpreted differently in four countries: the United States, Canada, Scotland and England. In each case, the particular policy environment has shaped the brownfield debate in distinctive ways, producing a different set of relations between the public and private sectors in brownfield redevelopment. Through this detailed comparison between the North American and Britain experience, the paper seeks to discover whether the main differences in understanding and tackling brownfield land can be attributed primarily to physical, cultural or institutional factors.

Keywords: Brownfield development, urban regeneration, land use change, urban land policy

1. Introduction

Over the past 20 years, the term 'brownfield' has become an important focus for urban policy on both sides of the Atlantic. Confusion in meaning, inconsistency in information, and variation in official priorities have matched this rise in prominence. To assist comparative research and understanding, it is essential to highlight how the term 'brownfield' is used in different ways in different contexts.

The purpose of this paper is to explore and evaluate commonalities and differences between the brownfield agendas in North America and Britain. Specifically, it will compare policies and practices in the United States, Canada, Scotland and England in order to understand how distinctive features have arisen in the brownfield debate in each country.

In the next section, we begin by exploring how and why the term brownfield is defined in each country. In the third section, the paper draws on recent research and publicly available

[1] David Adams, Department of Urban Studies, University of Glasgow, 25 Bute Gardens, Glasgow G12 8RS, Tel +44 (0)141 330 6280 Fax +44 (0)141 330 4983, E-mail: d.adams@lbss.gla.ac.uk, Web: http://www.gla.ac.uk/urbanstudies/staff/adamsd.html

[2] Chris De Sousa, Department of Geography and Urban Studies Program, University of Wisconsin-Milwaukee, Bolton Hall, Room 410, PO Box 413, Milwaukee, WI, 53201-0413 U.S.A, Tel 414 229-4874, Fax 414 229-3981, E-mail desousa@uwm.edu, Web: http://geog.uwm.edu/faculty/desousa.html

statistics to examine the significance of brownfield land in each country, with attention then given to the most prominent former uses of such land in Section 4.

We then move on in Section 5 to evaluate and explain the importance attached by respective governments to brownfield redevelopment. Relevant public policies and initiatives are identified and compared. Alongside this, consideration is also given in Section 6 to the keenness of the private sector to promote on brownfield redevelopment, and in Section 7 to the main constraints to brownfield redevelopment in each country.

In the final section, where we summarise our analysis and conclusions, we also seek to comment on whether the main differences in understanding and tackling brownfield land between North America and Britain are due primarily to physical, cultural or institutional factors.

2. How and why is the term brownfield defined in each country?

The term 'brownfield' is a relatively recent addition to the official vocabulary of UK government. For many years, the emphasis was on derelict land, defined in England as "land so damaged by previous industrial or other development that it is incapable of beneficial use without treatment" (DCLGa, 2006). Derelict land reclamation was promoted as an instrument of regional policy from the 1960s, with local authorities encouraged to seek central government grants for the treatment of land scarred by mineral extraction (particularly from coal mining) or other industrial activity. Regular dereliction surveys revealed how reclamation struggled to keep up with the increasing impact of the deindustrialisation that occurred within cities from the mid 1970s onwards. As a consequence, derelict land grants were deployed more as an instrument of urban than regional policy, with their focus switched in the 1980s from the reclamation of urban fringe land primarily for soft-end uses such as parkland to that of inner city land for hard-end uses such as new business parks or housing schemes. Policy-makers thus became less concerned with the presence of contamination and more with the potential for redevelopment. In due course, derelict land policy was largely submerged within broader regeneration activity, with emphasis from the late 1980s placed on public-private partnerships intended to tackle the extensive industrial dereliction found across large swathes of Britain's cities.

Regeneration policy took a similar course in Scotland, although here derelict land was defined more precisely as "land which has been so damaged by development or use that it is incapable of development for beneficial use without rehabilitation and which is not being used for the purpose for which it is held or for use acceptable in the local plan or land which is not being used and where contamination is known or suspected (even if treatment is required only for the buildings thereon)" (SVDLS, 2005). The key point remained, however that while all contaminated land is by definition derelict, not all derelict land is contaminated. This matches the policy imperative of bringing land requiring some kind of treatment back into beneficial use, irrespective of the specific treatment required.

From the late 1970s onwards, the increasing extent of vacant but not derelict land within cities (DoE, 1992) presented a powerful challenge to UK planning policy, which had long sought to contain the force of counter-urbanisation through green belts and other landscape designations. As Couch and Fowler (1992) argued, while some land may be frictionally vacant owing to supply constraints in the development process, other sites may suffer from

demand-deficient vacancy, arising principally from cyclical changes in the level of demand, or structural vacancy, defined as land rendered permanently surplus to requirements by changes in technology or in the nature of demand. Since the containment of urban expansion was seen to require the re-use or recycling of redundant urban land, it mattered little whether that redundancy was primarily attributable to supply-side or demand-side factors. Thus the term 'brownfield' emerged in the UK, not as the encapsulation of any particular condition of the land, but rather as the opposite of 'greenfield' (Alker *et al.*, 2000; POST, 1998). The challenge then became one of producing a definition to fit the policy ('to increase brownfield redevelopment'), rather than the other way round. The solution, first officially articulated in the 60% brownfield housing target proposed for England in 1998, was apparently quite simple. If greenfield land has never previously been developed, then by definition, brownfield land must be that which has been previously developed.

As previously developed land (PDL) benefits from greater planning flexibility and in that potential exists for some overlap at the margin with land that has never been previously developed (for example, a redundant airfield in rural area, 90% of which is grassed), a clear official definition of PDL become necessary. Although this is now given at length in Annex B to Planning Policy Statement 3 (DCLG, 2006b)[3], it is neatly summarised by the ODPM (2005, p. 77) as "previously developed land that is unused or may be available for development. It includes both vacant and derelict land and land currently in use with known potential for redevelopment. It excludes land that was previously developed where the remains have blended into the landscape over time." This definition is the basis for the English statistics collected for the National Land Use Database (NLUD) reported later in the paper. In Scotland, there is an even more succinct definition of brownfield as "Land which has previously been developed. The term may encompass vacant or derelict land; infill sites; land occupied by redundant or unused buildings; and developed land within the settlement boundary where further intensification of use is considered acceptable" (Scottish Executive, 2003, p.19).

In the UK, the policy importance of bringing redundant urban land back into productive use, irrespective of its condition, has thus helped define 'brownfield' as previously developed land, whether contaminated or not. Moreover, official brownfield statistics give little or no information on the extent of brownfield land that is actually contaminated. The complete absence of such statistics in England is explained by the comment in NLUD (2006, p. 50) that "The identification and classification of previously developed sites in NLUD PDL makes no representation on the likely presence of contamination. . . The identification of contaminated land is dealt with under the new regime for contaminated land set out in DETR Circular 2/2000, Contaminated Land: Implementation of Part IIA of the Environmental Protection Act 1990."

[3] Annex B states: "Previously-developed land is that which is or was occupied by a permanent structure, including the curtilage of the developed land and any associated fixed surface infrastructure. The definition includes defence buildings, but excludes:

- Land that is or has been occupied by agricultural or forestry buildings.
- Land that has been developed for minerals extraction or waste disposal by landfill purposes where provision for restoration has been made through development control procedures.
- Land in built-up areas such as parks, recreation grounds and allotments, which, although it may feature paths, pavilions and other buildings, has not been previously developed.
- Land that was previously-developed but where the remains of the permanent structure or fixed surface structure have blended into the landscape in the process of time (to the extent that it can reasonably be considered as part of the natural surroundings)"

Up to 2005, the Scottish Vacant and Derelict Land Survey (the main source of relevant statistics north of the border) had used rather a loose definition of contamination, on the basis of which it reported that in 2005 almost 1,200 hectares or some 16% of all derelict land in Scotland was in some way contaminated. The following year, after the survey had changed its definition of contamination to the more precise requirements of the Environmental Protection Act 1990, it reported that the extent of land known to be affected by contamination was only 132 hectares or less than 2% of all derelict land in Scotland. Interestingly then, the Freedom of Information (Scotland) Act 2002, which has made local authorities unwilling to report land as contaminated unless it meets the narrow requirements of the Environmental Protection Act 1990, effectively served to reduce the extent of officially recognised land contamination in Scotland by some 89%! As this demonstrates, there is little connection between the words 'brownfield' and 'contamination' in the UK, with the policy emphasis placed not on why land became vacant or derelict, but rather on the processes by which it might be put to use in future.

As the brownfields issue has evolved in the US and Canada, so has its definition in these two countries. The original focus in both countries in the early 1980s was on contamination. The distinction was often made between *known* contaminated sites—those that had been identified through appropriate testing—and *potentially* contaminated sites—those suspected of being contaminated because of their previous land-use (e.g., waste disposal, manufacturing, military operations, petroleum-based activities, dry cleaning, etc.) or else resulting from an on-site environmentally-detrimental event, such as a chemical or fuel spill. The term brownfields was adopted in order to attenuate the negative connotations and liability implications associated with the label *contaminated* lands.

The earliest known use of the term *brownfield* can be traced in the 1970s to the US steel industry, where the phrase 'brownfield expansion' came into vogue to designate a specific type of process for modernizing existing steel plants (Yount 2003). The term was generally used in economic development circles to refer to a particular kind of urban property, but it did not specifically connote a potentially contaminated site. According to Yount (2003, p. 26), it was Charles Bartsch from the Northeast Midwest Institute, a US non-profit agency, who employed the term 'brownfield' during a conference on managing old industrial property in the early 1990s. The name caught on and has been used ever since in print, in conferences, and in discussions within both public- and private-sector circles.

The most commonly used definition of brownfield in both the US and Canada is the one put forward by the US EPA when it formally launched its Brownfields Action Agenda in 1995. The agency defined brownfields as "abandoned, idled, or under-used industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination." A more recent definition put forward in the US *Small Business and Liability Relief and Brownfield Revitalization Act* (Public Law 107-118, H.R. 2869, p. 6), signed into law in 2002, has changed the definition slightly to: "Real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant."

As a concept, brownfields continues to refer to both *known* and *potentially* contaminated sites. Direct reference to commercial and industrial sites is no longer implicit in the term, for the reason that these are not the only sites with the potential for contamination and, more importantly, because there is growing interest from the market and the general public for housing and other forms of redevelopment on such sites. As Yount (2003, p. 32) cogently

argues, the current definition is thus "superior to others now in use in that it employs unambiguous terms and gives policymakers and practitioners flexibility to address brownfields as both environmental and economic problems."

Canada has also modified its definition over the years, from the rather expansive one put forward by the *National Round Table on the Environment and the Economy* in 1998, which reads as follows (NRTEE 1998, p. 4):

> Brownfield sites are abandoned or under-used properties where past actions have caused real or suspected environmental contamination. Although they are classified as a subset of contaminated sites, these sites exhibit good potential for other uses and usually provide economically viable business opportunities. They are mainly located in established urban areas, where existing municipal services are readily available, or along transportation corridors. They may include, but are not limited to decommissioned refineries, railway yards, dilapidated warehouses, abandoned gas stations, former dry cleaners, and other commercial properties where toxic substances may have been stored or used.

The revamped definition goes back to 2003 and is now in line with the US definition (NRTEE 2003, p. ix): "Abandoned, idle or underutilized commercial or industrial properties where past actions have caused known or suspected environmental contamination, but where there is an active potential for redevelopment."

While the term *contaminated land* continues to be used in legislative contexts in Canada, the term brownfield has become generally favoured by both public and private sector stakeholders because it avoids the negative connotations associated with word *contaminated* and because it constitutes a semantic counterpart to *greenfield*, the term used to refer to an agricultural or open space site located in the urban periphery. Interestingly, there continues to be the inclusion of development potential (reflecting property market viability) in the Canadian definition and a reference to commercial and industrial property, although this will likely change over time to conform to the US definition.

Unlike the UK and Scotland, vacant and unused land that is not suspected of contamination is not labeled as a brownfield. This has led to the continued use of the term vacant land and to the creation of terms such as 'greyfield', which refers to outdated retail and commercial sites. There has been some consideration to applying the brownfields term more broadly to encompass all vacant land as a consequence of the ever-increasing positive attitudes toward brownfield redevelopment in the US and Canada. While this might be laudable from an urban renewal point of view, it may face administrative barriers. In the US, the brownfields issue is largely under the auspices of the US Environmental Protection Agency and state environmental agencies and thus must retain an environmental focus, whether it refers to contamination or to the larger question of sustainability. Many Canadian provinces have also kept the focus on contamination so as to minimize the risk of local government interference into the property market, both within and between cities. Government support is thus enlisted to help assess and remediate contaminated land and buildings on brownfields so that they are on a more level playing field with clean sites and greenfields. Beyond this, government does not seem want to be seen as subsidizing private redevelopment.

3. How significant is brownfield land in each country?

As already intimated, the two main UK data sources tracking the extent of brownfield land are the National Land Use Database (NLUD) and the Scottish Vacant and Derelict Land Survey. While both surveys are published on an annual basis, allowing trend information to be portrayed, NLUD is more recent and provides a clearer view of development potential.

NLUD was launched in 1998, updated in 2001 when minor changes were made to the definitional base, and has thereafter been published on an annual basis. Significantly, the database is not limited to land and buildings already vacant but seeks to make some assessment of important redevelopment opportunities likely to arise in the future, even if still in current use. It therefore categorises entries under five headings:

- Previously developed land which is now vacant
- Vacant buildings
- Derelict land and buildings
- Land or buildings currently in use and allocated in the local plan and/or having planning permission
- Land or buildings currently in use where it is known there is potential for redevelopment (but the sites do not have any plan allocation or planning permission)

In each case, NLUD makes some estimate of residential development potential by indicating the extent of land considered suitable for residential development and the dwellings capacity, given certain (changing) density assumptions. Since NLUD information is gathered from individual local authorities, the results are presented nationally, by the nine English regions and for each local authority. Our concern here is primarily with trends in the national figures since 2001, when the current definitional base was established. These are presented in Table 1.

As Table 1 shows, in 2005 some 63,490 hectares of land in England was either vacant, derelict or considered to have redevelopment potential. To set this figure in context, it represented some 5.5% of the total developed area of urban England. (This proportion varied from 2.4% in London to 7.4% in the North West). Between 2001 and 2005, there was an 11% reduction in the extent of vacant land and buildings in England, but a 10.5% increase in land currently in use but considered to have redevelopment potential. While the extent of land within NLUD considered suitable for housing (about 43% of the total by 2005) fell slightly between 2001 and 2005, the dwellings capacity rose by about 7% over this period, primarily because density assumptions were increased as a result of changing government policy. The three regions with the highest amount of vacant and derelict land and buildings in 2005 were respectively North West England, Yorkshire and the Humber and the West Midlands, each of which has borne the brunt of successive waves of deindustrialisation from the mid 1970s. In contrast, the prosperous South East of England had by far the largest amount of land currently in use but considered to have redevelopment potential, so highlighting the strength of market demand as the main redevelopment driver.

Table 1 Trends in previously-developed land by land type: England 2001, 2002, 2003, 2004 and 2005 (Hectares)					
Land/building type	**2001**	**2002**	**2003**	**2004**	**2005**
Vacant and derelict land and buildings					
Previously-developed vacant land	14,730	15,680	14,610	14,100	13,920
Derelict land and buildings	21,410	19,960	20,550	19,870	18,720
Vacant buildings	4,990	5,070	4,550	4,200	3,920
All vacant and derelict land and buildings	**41,130**	**40,710**	**39,710**	**38,170**	**36,560**
Index (2001 = 100)	100.0	99.0	96.5	92.8	88.9
Currently in Use					
Allocated in a local plan or with planning permission for any use	14,030	16,570	17,580	18,120	18,920
Known redevelopment potential but no planning allocation or permission	10,350	8,830	8,470	7,840	8,010
All currently in use	**24,380**	**25,400**	**26,050**	**25,960**	**26,930**
Index (2001 = 100)	100.0	104.2	106.8	106.5	110.5
Total	**65,510**	**66,110**	**65,760**	**64,130**	**63,490**
Index (2001 = 100)	100.0	100.9	100.4	97.9	96.9
Residential development potential					
Land considered suitable for housing	28,060	28,000	29,000	28,600	27,600
Index (2001 = 100)	100.0	99.8	103.3	101.9	98.4
Dwellings capacity	919,100	870,000	950,000	986,000	981,000
Index (2001 = 100)	100.0	94.7	103.4	107.3	106.7
Density assumption	32.8	31.1	32.8	34.5	35.5
Source: Department of Communities and Local Government (2006)					

Table 2: Vacant and Derelict Land in Scotland: Components of Change Analysis 1996-2006 (Hectares)											
	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Year Start											
Stock of derelict land brought forward	8778	8482	7858	7787	7237	7148	6825	7614	7624	7658	7615
Stock of vacant land brought forward	4944	4619	4612	4425	4371	4086	3692	2982	2890	2819	2874
Total vacant and derelict land brought forward	**13722**	**13101**	**12470**	**12212**	**11608**	**11234**	**10517**	**10596**	**10514**	**10477**	**10489**
Inflows											
Land becoming derelict	192	228	542	460	363	234	932	293	190	331	155
Land becoming vacant	234	382	369	479	184	287	210	196	220	385	300
Total inflows	**426**	**610**	**911**	**939**	**547**	**521**	**1142**	**489**	**410**	**716**	**455**
Ouflows											
Derelict land reclaimed	293	616	468	764	301	449	293	308	181	448	252
Vacant land brought into use	395	374	355	537	299	343	391	271	285	287	305
Derelict land removed from register for definitional reasons	329	98	288	146	171	106	116	72	136	11	42
Vacant land removed from register for definitional reasons	50	79	106	59	35	249	237	88	37	13	73
Derelict land removed from register owing to naturalisation					64	185	187	101	1		
Vacant land removed from register owing to naturalisation					12	67	30	13		72	90
Total outflows	**1067**	**1167**	**1217**	**1506**	**882**	**1399**	**1254**	**853**	**640**	**831**	**762**
Other Adjustments											
Unexplained change in derelict land	134	-138	143	-100	84	183	453	198	162	85	4
Unexplained change in vacant land	-114	64	-95	63	-123	-22	-262	84	31	42	200
Total other adjustments	**20**	**-74**	**48**	**-37**	**-39**	**161**	**191**	**282**	**193**	**127**	**204**
Total Net Flow	**-621**	**-631**	**-258**	**-604**	**-374**	**-717**	**79**	**-82**	**-37**	**12**	**-103**
Year End											
Stock of derelict land carried forward	8482	7858	7787	7237	7148	6825	7614	7624	7658	7615	7480
Stock of vacant land carried forward	4619	4612	4425	4371	4086	3692	2982	2890	2819	2874	2906
Total vacant and derelict land carried forward	**13101**	**12470**	**12212**	**11608**	**11234**	**10517**	**10596**	**10514**	**10477**	**10489**	**10386**
Derelict land as % of total stock	64.7	63.0	63.8	62.3	63.6	64.9	71.9	72.5	73.1	72.6	72.0
Vacant land as % of total stock	35.3	37.0	36.2	37.7	36.4	35.1	28.1	27.5	26.9	27.4	28.0
Net flow due to real change	-262	-380	88	-362	-53	-271	458	-90	-56	-19	-102
Net flow due to definitional, natural or unexplained change	-359	-251	-346	-242	-321	-446	-379	8	19	31	-1
Source: Scottish Vacant and Derelict Land Surveys 1996-2006											

The overall pattern of change shown in Table 1 subsumes both inflows and outflows. For example, although the total amount of NLUD land fell by only 1% between 2004 and 2005 (from 64,130 to 63,490 hectares), this disguised the fact that some 6% of the 2004 total was developed by 2005, and another 4% was withdrawn from the survey as it no longer fitted the definitional requirements. This outflow was matched by an inflow equivalent to 7% of the 2004 total. There is an important lesson here for those who mistakenly concentrate on the brownfield stock and see it as a finite resource, gradually to be whittled down to zero. In fact, annual flows into and out of the stock are likely to be far more significant in the long term, since they reflect the reality of a complex redevelopment process in which redundancy will always be producing new brownfield sites, while redevelopment will be making use of others. The relative balance between these two forces at any point in time will be the main determinant of changes in the stock.

A clearer picture of how these components of change affect the overall stock each year can be gleaned from the Scottish Vacant and Derelict Land Survey, which has been undertaken north of the border over a longer time period than NLUD. The results (presented in Table 2) again shown how the almost static stock of vacant and derelict land between 2001 and 2006 disguises significant annual inflows and outflows. These may be due to real change (redundancy or redevelopment) naturalisation or to definitional or unexplained change. Even though the latter are a relatively small proportion of the total stock, they can have an important influence on the annual flow, suggesting room for improvement in the way the data is collected. It is not easy to assess the proportion of urban land in Scotland that is vacant or derelict since the limited results that are presented in SVDLS refer to administrative areas as a whole, rather than merely to their urban components. However, taking the case of Glasgow, which is the most urbanised administrative area in Scotland, SVDLS suggest that vacant and derelict land accounted for over 7% of its area in 2006. In comparison, NLUD suggest that vacant and derelict land and buildings in London account for some 0.7% of its urban area. It would thus appear that proportionately, land vacancy and dereliction is at least ten times worse in Glasgow that London, which looking at the NLUD results across England, probably has the highest concentration of brownfield land in either Scotland or England.

Since the Scottish survey does not include land currently in use with redevelopment potential, its results are not wholly comparable with those produced by NLUD for England. However, the almost minimal reduction between 2001 and 2006 compares poorly with the picture for vacant and derelict land and buildings in England and is the result of two main factors. The first, which illustrates how individual but exceptional decisions can have a disproportionate impact on the total stock, was the closure of a major weapons factory in 2002, which added some 566 hectares to the stock of dereliction in Scotland. The second, to which we shall return later, was the significantly lower levels of derelict land reclamation in Scotland from 2002 to 2006 compared to the period from 1997 to 2001.

In the US, federal tracking of brownfields and their redevelopment is sporadic and, additionally, does not involve accurate accounting. The US EPA estimates that there is anywhere from 450,000 to one million brownfields across the country. The often-used estimate from the US General Accounting Office of between 130,000 and 450,000 contaminated commercial and industrial brownfields is over a decade old. Using various federal and state databases, Simons (1998) estimated already a decade ago that there was over 384,400 listed brownfields. Utilizing an economic base analysis, he calculated that there were over 75,000 brownfields in 31 of the country's largest cities taking up over 114,000 acres (46,135 hectares), or 6%, of city land. His method of calculation included an array of former

industrial properties, abandoned gas stations, hazardous waste facilities, landfills, and other relevant commercial operations.

Over time, a tiered system has crystallized whereby the different levels of government (federal, state, local) work in tandem to compile and manage different kinds of brownfields information. Hazardous waste sites that are deemed to pose the greatest risk to human health and the environment are placed on the EPA's computerized inventory system (CERCLIS), thus coming under the jurisdiction of the *Superfund* program. Of these, sites that exceed a designated hazardous ranking are put on the more comprehensively managed *National Priorities List*, while those that do not are assigned instead to state inventories. As of January 2007, 1,618 sites were listed on the National Priorities List (1,240 of these active, 61 proposed, 317 archived). The Resource Conservation and Recovery Act also created the RCRIS tracking system, now replaced by RCRAInfo, which tracks hazardous materials from 'cradle to grave', so to speak, and requires states to track underground storage tanks, solid waste facilities, and hazardous waste sites.

Many states also maintain inventories of brownfield sites, although there is no standardized approach for identifying the types of sites to be included or the information maintained. The state of Wisconsin, for instance, has developed a computerized system that catalogues sites on the basis of whether they require management (open sites) or not (closed sites), what type of brownfield it is (as resulting from a spill, as resulting from leakage of an underground storage tank, etc.), whether it is to be considered a high, medium, or low priority, and whether land use limitations or conditions have been placed on it following an environmental cleanup. Many states also maintain extensive records on brownfield projects involved in their voluntary cleanup programs, although the data recorded in such cases is highly variable. A report by the US EPA (2006) estimates that over 48,000 brownfields have already been completed via state voluntary cleanup programs. Unfortunately, the type of information gathered by most states does not allow for an assessment of the overall increase or decrease in brownfield sites or abandoned redevelopment projects generally, making it difficult to track progress.

Many local governments have developed their own brownfields inventories, often with the use of funds from the federal government, but sites in such inventories may not be similarly defined, making accurate comparison difficult, and often impossible. In 2006, the US Conference of Mayors surveyed 201 cities, finding that 172 have circa 23,810 brownfields averaging in size from 5 to 15 acres (2 to 6 hectares), with 158 cities encompassing a total of 96,039 acres (38,866 hectares). Many cities gather and maintain information on the environmental problems and economic opportunities available at these sites, using their inventories as real estate portfolios, particularly in the case of properties owned by the city. However, the lack of a common and systematic approach to the classification of brownfields in the US makes it difficult to assess the state of the problem and the effectiveness of policy efforts, beyond the case study or the city-specific review.

In the early 1990s, the Canadian federal government made a genuine attempt to develop a national approach to brownfield inventory-making. The effort did not meet with success because provinces were unable to reach an agreement on the scope and potential use of a contaminated sites inventory (Auditor General of Canada, 1995). Consequently, the federal government set up a *Contaminated Sites Management Working Group* in 1995 with the mandate of gathering appropriate information only for federal lands. Since its inception, the Group (1997) has identified over 4,400 federal sites as having undergone some form of

environmental site assessment. From those assessed, action is definitely required at 860 sites, probably required at another 1,784 sites, and is likely to be required at the remaining 1,088 sites. Federal departments have also developed a consistent definition of contaminated sites and classify them based on the extent to which they require remedial action.

Except for federal contaminated sites, only sporadic data can be found with regard to the brownfields situation in Canada. Estimates of potentially contaminated brownfield sites range widely from between 2,900 (NRTEE 1996) to 30,000 (Sisson 1989). There does not exist a standard municipal approach for the making of brownfield inventories and only a handful of cities have developed one of their own. Data compiled from surveys reveal that there are over 1,900 brownfields and 28,000 acres (11,331 hectares) in eleven of the country's largest cities (De Sousa 2006a), estimated to comprise 3.3% of urban land, a figure that contrasts with the 6% estimated for US cities (Simons 1998). As for redevelopment projects, the data is similarly patchy. Among the findings of a survey of Canadian cities (De Sousa 2006a), it was found that 203 remediation/redevelopment projects were completed in 12 Canadian cities with 47% of all redevelopment activity being residential, followed by retail (20%), commercial/office (16%), open space (12%), industrial (2%), and institutional (2%).

Many cities and government agencies continue to postpone the development of formal brownfields inventories for fear that properties might be stigmatized and their values reduced, with liabilities ensuing for the agencies involved in compiling the inventories. A broader focus on sustainable development and urban sprawl, which would require analysis of whether development is shifting from greenfields to brownfields, might help overcome the various problems that have plagued the brownfield issue in North America.

4. What were the most prominent former uses of brownfield land in each country?

Information on the previous use of brownfield land in England is still quite patchy. NLUD reports only the previous use of land redeveloped in the particular year of the survey. Even this information is unhelpful, since the 2005 returns, for example, suggest that 50% of the land redeveloped in that year was previously vacant or derelict, 23% industrial or commercial, 17% residential and the balance other uses. A more longitudinal picture should be available from the Land Use Changes Statistics, which have been published for England since the mid 1980s, but available statistics (DCLG, 2006c) merely suggest that about 42% of brownfield land redeveloped for residential use over the 1995 to 2005 was previously vacant or derelict, 32% already in residential use and the remaining 26% in all other uses combined. This lack of hard evidence in England is due partly to the length of time some sites have remained vacant and derelict and partly to the limited importance attached to previous use in designing the relevant information systems.

To gain a better picture of previous use, it is necessary to turn to Scotland, where SVDLS contains such information on almost 85% of vacant and derelict land in the 2006 survey. The most rapid growth in recent years has been in former defence land, which by accounted for 19% of the SVDLS land where the former use was known. This was slightly below the most prominent former use, mineral activity at 21%, but ahead of manufacturing at 17%. The only other prominent former uses were agriculture at 9% (which would have been excluded from NLUD in England) and community & health at 8%. Although SVDLS does not cross-tabulate former use with the length of time sites have lain vacant or derelict, the above picture is not inconsistent with the anecdotal view of 'waves' of land redundancy with significant mining

closures experienced from the late 1960s, manufacturing closures from the late 1970s and defence closures and public service reorganisations from the mid 1990s.

In the US, in terms of listed brownfields, Simons (1998) found that in 1996 most brownfield sites were leaking underground storage tanks (64%), followed by state hazardous waste sites (15.9%), Solid Waste Facilities (9.9%), No Further Remedial Action Planned (6.3%), CERCLIS sites (2.6), RCRA Treatment, Storage, and Disposal sites (0.9%), and National Priority List sites (0.3%). Federal, state, and local inventories in the US do not typically catalogue brownfields by former land-use designation. Heberle and Wernstedt (2006) reviewed various research studies to get an idea of former use, finding that in one study (the XL/IEDC review) industrial activities accounted for about 70% of brownfields, with public facilities (mostly military) and commercial uses accounting for most of the remainder. In an environmental insurance survey of nearly 50 private developers, Heberle and Wernsted (2006) also found that sites under redevelopment had most commonly hosted light/heavy industry (32%), mixed use (26%), commercial (22%), and residential (11%) activities; with many having housed several former uses.

In a study of brownfields housing projects in Milwaukee and Chicago, De Sousa (2006b) found that slightly over one-third (36%) of the sites were vacant prior to redevelopment, followed by transportation (20%), industrial (19%), retail (15%), residential (8%), and commercial (3%); and over half (53%) having been affected by multiple uses. In the Chicago case, most of the brownfield sites converted into housing had previously been industrial or warehouse properties (44%), followed by retail (21%), residential (17%), transportation (15%), and commercial sites (12%). Several had also been vacant before redevelopment (12%). A salient feature of the brownfields-to-housing projects in both cities is their diversity in terms of both the former use of sites and the size of the projects. Slightly over half (53%) of the projects involve sites that are less than one acre in size (0.4 hectares), while 25% are between one and three acres, and 22% over 3 acres (1.2 hectares). In Chicago, there is almost an equal proportion of projects less than one acre (46%) and between one and five acres (44%), while 10% are over 5 acres (2 hectares). Most projects in Milwaukee are located relatively close to the city's downtown core, where the property market is strongest, while in Chicago they are scattered throughout the city, reflecting the stronger residential market of that city. In the case of Canada, it is generally assumed that brownfields result from similar uses to those in the United States, but there is no definitive study showing this to be the case.

5. How much importance do governments in each country attach to brownfield redevelopment?

There has been a clear correlation, at least in England, between government interest in brownfield redevelopment and the extent of public and political concern about environmental matters and, specifically about the likely scale of prospective greenfield development. Three specific turning points in brownfield policy illustrate this well. In March 1995, the then Conservative Government published new and highly controversial household projections, which suggested that households numbers in England would increase by 4.4 million (or 23%) between 1991 and 1995 (DoE, 1995). Subsequently, that June, it announced that it wished to see half of all new homes in England built on re-used sites. It explained the context for this decision as follows: "Demand for housing is growing and we must meet it in an environmentally sustainable way. We live in a densely populated country. We need to use our

resources effectively, building where possible on existing urban land rather than greenfield sites, and reducing the number of empty homes" (DoE, 1995b).

As Murdoch (2004, p. 53) comments: "The publication of this (4.4 million) figure conjured up the spectre of new houses spreading across the English countryside. It therefore allowed the Campaign for the Protection of Rural England (CPRE) and other environmental groups to mount a serious challenge to the 'demand-led' discourse, which they claimed had long prevailed within the planning-for-housing arena. This challenge profoundly affected the political context around planning and led John Major's Conservative government to defer making any decision on the allocation of land for the required new homes prior to the 1997 General Election. Thus, Tony Blair's Labour Government inherited a planning for housing crisis and needed to quickly put a viable planning-for-housing policy into circulation. In formulating its proposals, the new government seemed surprisingly receptive to CPRE's views." This crisis heralded the second turning point in brownfield policy which came in 1998 when John Prescott, the incoming minister responsible for planning and housing announced that the new Government intended "to raise the proportion of new homes we expect to be built on previously developed land from 50% to 60%, to be achieved over the next ten years" (DETR, 1998, paragraph 4). In the final version of this policy, it was decided to include conversions within the 60% target, which was then formally expressed as follows: "The national target is that by 2008, 60% of additional housing should be provided on previously-developed land and through the conversion of existing buildings" (DETR, 2000a, paragraph 23).

It is, of course, easier to formulate such a policy than implement it. While headline figures suggested a steady improvement in the target figure from 58% in 1998 to 64% in 2001, this disguised an almost static picture in the number of dwellings completed on brownfield land in England, which remained around 83,000 in both years (see Table 3). This was a classic case where the virtual reliance of the policy on the planning system to refuse greenfield development helped cut overall housebuilding from 143,000 in 1998 to just below 130,000 in 2001, while doing almost nothing to produce additional brownfield development. The resultant concerns over increasing house prices and restricted affordability caused the Government to establish the Barker Review of Housing Supply (2003 & 2004) and produced the third turning point in brownfield policy, with the publication of the Sustainable Communities Plan (ODPM, 2003).

To address the growing housing shortage, especially in South East England, the Sustainable Communities Plan proposed additional development of some 200,000 houses by 2016 above previously planned figures to be built in four growth area, three of which were primarily greenfield locations. Such a proposal would have been politically unfeasible in the context of intense pressure from anti-development and environmental interests, unless matched by a more explicitly interventionist approach to brownfield development to replace the previous mere reliance on a target figure. The heart of this new interventionist approach involved "a new strategic role" for English Partnerships (the Government's urban regeneration agency) "to find and assemble land, especially brownfield and publicly owned land, for sustainable development" (ODPM 2003, p. 40). Crucially, English Partnerships was charged with developing a comprehensive national strategy for brownfield land and allocated over £500 million over three years to find and assemble housing sites. Although this was not devoted entirely to brownfield development, it enabled the agency to play a central enabling role in the development of the Thames Gateway, the fourth and largely brownfield growth area identified in the Sustainable Communities Plan.

Table 3: Total dwellings built on previously-developed land plus estimated conversions in England 1985-2005									
Year	**Land**					**Dwellings**			
	Total hectares of land used for new housing	Percentage of new dwellings built on previously developed land	% of land used for new housing that was previously developed	Total hectares of land used for new housing that was previously developed	Index of land used for new housing that was previously developed	Total new dwellings completed	% of dwellings built on previously developed land plus estimated conversions	Total dwellings built on previously developed land plus estimated conversions	Index of dwellings built on previously developed land plus estimated conversions
1985	8760		39	3416	107.8				
1986	7055		38	2681	84.6				
1987	7500		38	2850	89.9				
1988	7730	52	41	3169	100.0				
1989	6075	51	43	2612	82.4		55		
1990	8160	50	43	3509	110.7	163899	54	88505	107.0
1991	5020	53	45	2259	71.3	154595	53	81935	99.0
1992	5750	53	46	2645	83.5	143831	56	80545	97.4
1993	5955	51	46	2739	86.4	147835	56	82788	100.1
1994	6230	54	46	2866	90.4	154641	54	83506	100.9
1995	5810	54	48	2789	88.0	157141	57	89570	108.3
1996	5120	54	48	2458	77.5	149086	57	84979	102.7
1997	5630	53	47	2646	83.5	149493	56	83716	101.2
1998	5490	55	48	2635	83.1	142651	58	82738	100.0
1999		56	50			141010	59	83196	100.6
2000	5350	59	52	2782	87.8	135098	62	83761	101.2
2001	5450	61	55	2998	94.6	129507	64	82884	100.2
2002	5030	64	57	2867	90.5	136803	67	91658	110.8
2003	5220	67	58	3028	95.5	144058	70	100841	121.9
2004	3640	72	62	2257	71.2	154065	74	114008	137.8
2005		74	63			159454	77	122780	148.4
2006		71	63			160761	74	118963	143.8
Source: Department of Transport, Local Government & the Regions (2001) & Department of Communities and Local Government (2006) & (2007)									

Other actions taken by English Partnerships included recourse to compulsory purchase powers to assemble brownfield land and an explicit programme targeted at the 17,000 hectares of hardcore brownfield land registered on NLUD, which has remained vacant or derelict since 1993. By 2005, the results of this more interventionist approach to brownfield land were beginning to show, with almost 123,000 dwellings completed on brownfield sites in that year. It had taken over a decade for the Government to realise that real test of its 'brownfield first' approach was not its apparent commitment in principle but its willingness to devote powers and resources to effective intervention in the land market.

Unfortunately, this is a lesson that has still to be learnt in Scotland. Instead of a national brownfield target, local planning authorities are encouraged to "promote the re-use of previously developed land in preference to greenfield land, provided that a satisfactory residential environment can be created" (Scottish Executive, 2003, paragraph 29). No public agency has prime responsibility for the reduction of vacant and derelict land and expenditure is modest, with some £20 million committed for reclamation activities in Glasgow, North Lanarkshire and Dundee from 2004 to 2006 and a further £24 million promised from 2006 to 2008 (Scottish Executive, 2006).

Until the mid to late 1990s regeneration activity in Scotland had a strong physical dimension, including an emphasis on bringing brownfield land forward for redevelopment. Subsequently, it concentrated instead on economic development and social inclusion, especially after the election of the newly-devolved Scottish Parliament in 1999. This is compounded by the uneven geographical distribution of brownfield land in Scotland, for as the National Planning Framework (Scottish Executive, 2004, paragraph 156) makes clear "While the greatest opportunities for reusing previously developed land lie in Glasgow and the Clyde Valley, the demand for land for new development is focused more strongly on the East. Even with a more even pattern of economic activity, there will be a need to accommodate a substantial growth in the number of households in or close to the Edinburgh city region over the next 25 years." As Table 2 showed, there has thus been hardly any reduction in vacant and derelict land in Scotland since 2001. This unwelcome pattern is unlikely to change without a radical re-think of brownfield land policy in Scotland.

In 1994, the US Conference of Mayors cited brownfields cleanup and redevelopment as their top priority. Since then, policy efforts aimed at redeveloping brownfields, reducing risks to the environment and public health, and restoring blighted communities continue to receive political support despite a general decline in the public's interest in toxic waste issues and the Bush Government's general apathy towards environmental issues. The Congressional vote to pass the Small Business Liability Relief and Brownfields Revitalization Act was overwhelming and bi-partisan (Wernsted et al., 2004). Funding for the brownfields programs has also remained stable over the last half-decade despite the decline experienced in other environmental domains. Numerous groups representing a wide range of interests—developers, engineers, local officials, lenders, regulators, non-profits, and the environmental community—continue to support brownfields redevelopment.

Most of the financial and regulatory support for brownfields redevelopment in the US since the mid-1990s has been earmarked for economic development projects that seek to create or preserve businesses, jobs, and taxation structures in the inner city, particularly in Northeast and Midwest areas affected by deindustrialization. Those involved in housing development have pointed out that it continues to be difficult to obtain funds for such projects because the criteria for evaluating grants put significant emphasis on jobs and tax benefits. This is

changing, however, as market demand for housing in many cities improves with the influx of young professionals and "empty nesters" into urban centres. While arguments related to the environment and urban sprawl have lent support to brownfields redevelopment generally, and residential redevelopment specifically, the primary motivation in the US has been economic development.

Despite the fact that stakeholders in Canada also decry the complexity, uncertainty, and variability of the regulatory systems in place to oversee remediation and redevelopment, there has been relatively little attention given to the issue by the federal government. Indeed, the role of this government in brownfields redevelopment has consisted largely of information gathering, federal property management, and financial assistance provision through the Green Municipal Fund program. In December 2001, the government initiated a national approach to brownfields redevelopment and assigned to the National Round Table on the Environment and the Economy (NRTEE) the task of developing a National Brownfields Redevelopment Strategy for Canada. The NRTEE convened a task force of stakeholders representing different interests who worked to develop recommendations for action at the municipal, provincial, and federal levels of government. The Strategy was delivered to the Prime Minister in 2003, and while the federal government has shown interest in its recommendations, it has yet to make any significant commitments to date with respect to brownfields.

Most of the regulation of brownfields in Canada is the responsibility of the provincial and municipal levels of government, which typically hold the private sector financially responsible for cleanup and redevelopment, seeing their own role primarily as regulatory and advisory. While these levels have responded proactively to the NRTEE recommendations, their interest and attention has been sporadic and varying, largely, according to the strength of the real estate market. Cities with a strong market, such as Vancouver and Toronto, along with the growing suburban municipalities, have been highly successful in realizing brownfield redevelopment projects, despite little or no financial and management assistance from local and provincial governments. A common strategy for dealing with industrial brownfields has been to rezone them to residential use—a use that has been in high demand, allowing developers to manage contamination while making a suitable profit. In Quebec stronger financial and management support from both local and provincial governments has made it possible to develop the weaker market areas. Unfortunately, smaller peripheral communities in Canada with industrial legacies, weaker real estate markets, and limited resources face a tough challenge because their plight is often overshadowed by the relative success of larger strong-market municipalities within the same province. This has induced the upper levels of government to take a more hands-off and piecemeal approach in implementing policy and funding measures, ultimately slowing down the development and convergence of such policies among Canadian municipalities and provinces. Nevertheless, rapid growth in some cities has rekindled provincial interest in urban sprawl and sustainability. The province of Ontario, Canada's largest, recently introduced greenbelt legislation aimed to provide a stimulus to the development of brownfields and various other empty pockets of urban land.

6. How keen is the private sector on brownfield redevelopment in each country?

The UK development industry has traditionally been divided between those firms that concentrate on commercial and industrial development and those that are primarily

housebuilders. Over the years, much commercial and industrial development has taken place on previously developed land, particularly in city centres, where major development companies worked in partnership with local authorities to redevelop obsolete central areas. Since the early 1980s, successive urban regeneration policies have encourage commercial developers to turn their attention to the production of retail centres, business parks and new offices in run down former industrial areas, including waterfront locations. While Ball *et al.* (2003) highlight the frustration experienced by developers and property agents at the slow and complex process of decision-making involved in many urban regeneration partnerships, Adair *et al.* (2004) have produced extensive evidence to show how the long-term investment returns from regeneration property exceed national and local benchmarks. Although BURA (2005) makes a strong case for government infrastructure commitments and tax breaks to encourage greater brownfield interest by the private sector, it is likely that as much attention will be paid to English Partnerships (2006) new Urban Regeneration Index, the most recent edition of which shows that urban regeneration areas have outperformed the market as a whole in office and industrial property and tracked it in retail.

Although housebuilding has turned its attention to brownfield redevelopment more recently, there is now substantial evidence to indicate a radical transformation over the past decade in the distribution of private residential output, at least in England. Research undertaken by Dixon et al. (2006) suggests that the largest English housebuilders were delivering between 50% and 74% of their output on brownfields in 2004, while small and medium-sized housebuilders had also modified their business activities towards brownfield development. Since Dixon et al. calculate that brownfield sites accounted for 70% of the building plots with planning consents held in housebuilders' land banks, it would seem that government policy has induced a fundamental shift in the place of production, at least in the short to medium term. Adams (2004) contends that speculative housebuilders who enthusiastically build up core competencies in brownfield housing are likely to emerge as the market leaders of the future, while those who continue to rely on past practices and technologies will face an uncertain future as greenfield development opportunities begin to reduce. This point is confirmed in a detailed case study of the Berkeley Group by Karadimitriou (2005). He writes "The leading PDL housebuilder in London, the Berkeley Group, was a 'first mover' and seems to have benefited substantially from this. Their ability to cope with the demands of PDL regeneration has ensured superior growth rates and converted them from an insignificant niche developer to an industry leader" (Karadimitriou, 2005, p. 283).

While several of the largest British housebuilders have thus enthusiastically embraced brownfield redevelopment, the WWF & Insight Investment Report (2005) shows that there is still widespread variation in the commitment of individual housebuilders to sustainability considerations more generally, despite an overall improvement during the previous year. It remains unclear whether and to what extent the recent and significant switch in private housebuilding industry from greenfield towards brownfield location represents an opportunity based business response to increased demand for more sustainable and centrally located homes rather than a mere reaction to policy pressure, which might be rapidly reversed if that policy were to be relaxed.

In both the United States and Canada, the private sector has shown a keen interest in brownfields redevelopment and has been pivotal in pushing the brownfields agenda forward, although there seems to be little hope at present of curbing the growth of the residential greenfield market in the US. As in the UK, the development industry in the US is subdivided into those firms that concentrate on commercial and industrial development and those that are

interested primarily in residential development. The first players in the urban brownfields market are typically well-established firms that specialize in higher density urban projects. As the brownfield market matures, however, firms involved in greenfield development tend to participate more willingly in the brownfields market. In Milwaukee, for instance, less than a fifth of brownfield developers are involved in more greenfield than brownfield projects, while in Chicago developers were involved in more greenfield than brownfields projects on an annual basis.

Interviews with private sector stakeholders in Milwaukee and Chicago (De Sousa 2006b) indicate that most of the factors attracting them to brownfields relate primarily to location and surrounding amenities, and to a lesser extent to the attributes associated with brownfield sites (i.e., the low price of land, lot size, availability of buildings for reuse, etc.), or to socio-economic factors (affordable housing, stabilizing neighbourhoods, etc.). The Milwaukee interviewees pointed out, in fact, that they were attracted to those brownfields that offer proximity to the downtown core, access to services, immediacy to good neighbourhoods, access to natural amenities, low land prices, and attractive views. Stakeholders in Chicago noted that they were attracted to a site's proximity to public transit and the strength of the area's property market. Several stakeholders also mentioned proximity to roadways and highways, good neighbourhoods, and gentrifying ('yuppifying') districts.

Research carried out in Canada in the late 1990s reveals that private sector stakeholders are motivated primarily by economic factors such as maximizing return on investment, divesting liability risks/costs, acting on the growing popularity downtown urban locations, and taking advantage of devalued brownfield property costs (De Sousa 2000). While the interviewees also identified environmental and social factors, these too were economically motivated—remediating a site to avoid any potential government intervention and protection of public health and safety to limit liability risks. As in the US, many of the same developers are involved in both brownfield and greenfield projects, and while there are efforts to promote more compact urban development in a few cities, there is little federal effort to curb greenfield development.

7. What are the main constraints to brownfield redevelopment in each country?

Redevelopment of brownfield land can be constrained on both the demand and supply sides. On the demand side, both NLUD and SVDLS reveal that brownfield potential is regionally imbalanced, with a disproportionate concentration found in regions with traditionally weaker property markets. For example, in 2005, the former heavily industrialised North West of England had the largest amount of any English region both of previously-developed land (11,900 hectares) and of that which was vacant or derelict (8,700 hectares). In contrast "there is a lack of readily available urban brownfield land in the Southern regions compared with the Midlands and Northern regions" (English Partnerships, 2006, p. 25). There is a similar uneven geographical distribution of brownfield land in Scotland, for as the National Planning Framework (Scottish Executive, 2004, paragraph 156) makes clear "While the greatest opportunities for reusing previously developed land lie in Glasgow and the Clyde Valley, the demand for land for new development is focused more strongly on the East." In short then, while the delivery of brownfield land policy would be facilitated if governments could move brownfield land around the country to the markets where demand was strongest, in the absence of such magical powers, it is necessary instead to stimulate demand in those regions where brownfield land is most concentrated.

Despite an extensive academic and policy literature of supply-side constraints to development, there is hardly any serious analysis in either NLUD or SVDLS of the extent to which brownfield land is so constrained. The nearest either sources approaches this crucial questions is in the analysis of development potential with SVDLS. This reveals that for sites where information was known in 2006, 41% of SVDLS land within settlements and 15% of that in the countryside was considered developable in the short term. If this is taken as a proxy for wholly unconstrained sites, it would suggest that almost 60% of urban land and 85% of rural land is in some way constrained. However the limited scope of this aspect of SVDLS cautions against over-interpretation of these figures and highlights instead the important research challenge of promoting consistent methods to classify and measure supply-side constraints to development. Traditionally, these have been conceptualised as falling under three main heading: planning/regulatory, physical and ownership.

Although central government enthusiastically promotes the redevelopment of brownfield land, planning or regulatory constraints may counteract this policy at a local level. Two reasons for this are worth particular mention. First, local planning authorities may wish to reserve sites for an apparently useful purpose for which current demand is low (for example, manufacturing industry) by preventing their immediate development for another purpose for which current demand is high (for example, housing). To discourage this, central government specifically advised local planning authorities in England to consider if their existing reservations of urban employment land were actually realistic, especially where they prevented the re-use of previously-developed land for housing or mixed-use development (DETR, 2000b). Secondly, potential local opposition to brownfield redevelopment should not be underestimated, especially in those parts of urban areas that "are perceived as over-developed, or overcrowded by their residents, where valuable open space has been lost, traffic is congested, and air, noise and light pollution are having a detrimental effect on the quality of life (Williams *et al.*, 1996, p. 93). Such resident opposition can readily influence the democratic process by which local planning decisions are made.

Physical constraints may include the presence of substantial underground obstructions, such as old foundations or machinery bases, and redundant services. New development on brownfield sites must also be carefully woven into the existing urban fabric. Vehicular access, for example, may be hard to provide unless adjoining land can be purchased to provide necessary visibility splays. Thus, even apart from the threat of contamination, Syms (2001) emphasises that it is important to appraise the physical characteristics of brownfield land in terms of site size, nature of the soil and subsoil, topography and relief, and prospective site attractiveness. However, as Gore & Nicholson (1985, p. 187) pointed out: "Physical constraints . . . do not necessarily prevent development, as they can normally be expressed in terms of extra preparation or construction costs." According to the Urban Task Force, even contamination (with the obvious exception of nuclear waste) should not be seen as a primarily technical problem since "In almost all cases, it is essentially a problem of finance and/or perceived legal risk" (Urban Task Force, 1999, p. 238).

Ownership constraints in the UK have been more systematically analysed than planning or physical constraints. Adams *et al.*, (2001) contend that an ownership constraint can be said to exist if development is unable to proceed because the required ownership rights cannot rapidly be acquired through normal market processes. On this basis, they suggest that five main types of ownership constraints can be identified:

- Ownership itself may be unknown or unclear;

- Ownership rights may be divided if the power of freehold owners to sell development land with immediate vacant possession is restricted by lesser rights in the same land;
- Ownership assembly may be required for development;
- Owners may be willing to sell but not on terms acceptable to potential purchasers;
- Owners may be unwilling to sell.

In their study of 80 large redevelopment sites in four British cities, Adams *et al.* (2001) found that such ownership constraints disrupted plans to use, market, develop or purchase 64 of the sites between 1991 and 1995. Altogether, 146 individual ownership constraints, or 1.8 per site, were found. Divided ownership rights proved the most prevalent form of constraint. However, since most existing leases on potential redevelopment sites were of short-term duration, their impact was limited. The need for ownership assembly was the most disruptive type of constraint. Multiple ownership of land, in particular, proved hard to resolve without the prospect of lucrative commercial development and/or state acquisition or intervention. Neither NLUD nor SVDLS currently collect such sophisticated information on ownership constraints. Their simple split between public and private ownership disguises the wide variation in ownership motives and behaviour within these sectors revealed by Adams *et al.* (2001).

In the US, many studies have been carried out over the last decade to identify and prioritize the broad array of problems caused by brownfields and the challenges facing their redevelopment from both a private and public perspective. The most recent US Conference of Mayors study (2006) found that the main public-sector impediment (156 or 87% of cities) continues to be a lack of clean-up funds, followed by the challenges posed by carrying out environmental assessments (110 cities or 61 percent) and by liability issues (97 cities or 54 percent). Indeed, these have been consistently identified as problems by the last five surveys carried out by that organization.

In terms of constraints to residential brownfields redevelopment, the most common concern expressed among private sector stakeholders in Milwaukee relates to the cost (or amount) of clean-up required, with a handful of respondents also mentioning liability risks, longer project duration, and unknown or “surprise” costs. Other barriers mentioned include the amount of responsibility for clean-up, the need to disclose the clean-up to purchasers, upfront site investigation costs, liability costs, zoning issues, and difficulties in obtaining financing. When comparing brownfields redevelopment to the development of greenfields, interviewees noted that there is an equal level of difficulty in terms of project planning and profitability, slightly more difficulty associated with acquiring brownfields, stakeholder involvement, and project financing, and much more difficulty related to site preparation. Interestingly, they also noted that it is slightly less difficult to promote brownfield projects because of the current popularity of many downtown locations.

In Chicago, the main barrier to residential brownfields redevelopment was also identified as being the cost (or amount) of clean-up. Many interviewees also emphasized the regulatory hurdles at both the state and city government levels that add to project duration. Other barriers identified include unknown costs, the difficulty of obtaining financing, weak markets, and a lack of public funding. A couple of interviewees stated that the barriers to brownfields redevelopment were however minimal. Surprisingly, no one mentioned liability risks. Overall, most developers surveyed in Chicago found all aspects of brownfields redevelopment to be as difficult or more difficult than greenfield development. While profitability was considered virtually the same, site acquisition, financing, planning and development, marketing, and stakeholder involvement were considered slightly more

challenging. Site preparation and project duration issues were considered much more difficult ones to deal with by the private sector.

In a 2000 study (De Sousa 2000), private-sector stakeholders involved in brownfields redevelopment in Ontario were asked to rank a list of obstacles with respect to how they are perceived to affect brownfield project costs and risks. The liability issue was perceived as the most severe obstacle, adding to project risks and costs, both directly (e.g., through higher legal fees) and indirectly (e.g., through reduced land values and time delays during the review process). Those interviewed also emphasized that regulatory mechanisms continue to constitute serious obstacles to redevelopment projects, despite efforts to streamline them, because they lengthen the redevelopment process. Moderate obstacles identified by the private sector pertained mainly to policy (i.e., overly stringent remediation requirements, uncertainty regarding the application of RBCA), financing (i.e., lack of governmental incentives in Canada, difficulties obtaining financing), and property perception factors. A recent study funded by the Canada Mortgage and Housing Corporation (2005) found that while redevelopment for housing faces the same barriers as those faced by brownfield redevelopment in general (i.e., liability, regulations, financing, technology, planning, stigma), liability and regulatory barriers are perceived as being more significant because of the greater number of end users, which increases the number of potential claimants and civil actions.

Many of the supply and demand oriented constraints found in the UK are also present in the US and Canada: e.g., population growth rates in the brownfields-rich Northeast and Midwest are lower than those experienced in the west and south, economic development agencies hold on to land for potential reindustrialization, privately-owned and underused sites are 'mothballed' by landowners until they are willing to sell, and there are physical characteristics that pose challenges. But these and other challenges have shifted over time as governments develop, implement, and tweak policies and programs to overcome them, particularly in the US. A good example of this is the downgrading of liability by many private sector stakeholders in the US, owing to the implementation of better protection for those undertaking redevelopment.

8. Conclusion

While there is now an active 'brownfield debate' on both sides of the Atlantic, this paper has identified the most important differences in that debate between England, Scotland, the United States and Canada. Table 4 summarises these for the six main areas of concern reviewed in this paper.

Table 4: Summary of Comparative Analysis: Britain and North America				
	England	**Scotland**	**United States**	**Canada**
Brownfield definition	Previously developed land – opposite of greenfield	Previously developed land – opposite of greenfield	Known or potentially contaminated land	Known or potentially contaminated land with redevelopment potential
Brownfield significance	About 5.5% of the total developed area of urban England brownfield & considered to have redevelopment potential in 2005	Difficult to tell, but over 7% of Glasgow, Scotland's most urbanised administrative area, vacant or derelict in 2006	Difficult to tell, but probably between 450,000 and 1 million brownfield sites across US	Difficult to tell, but probably between 2,900 and 30,000 brownfield sites across Canada
Most prominent former use	Difficult to tell	Former mineral activity (21%) defence uses (20%) manufacturing (19%)	Difficult to tell, but studies suggest prominence of former industrial use	Information not known, but pattern likely to be similar to US
Policy importance	Increasing importance, especially since 1998 for residential redevelopment	Residential development encouraged, but less important than in England	Increasing policy importance, especially for economic redevelopment	Geographically variable since only limited interest from federal government
Private sector interest	Most private sector housebuilding now on brownfield land	Most private sector housebuilding now likely to be on brownfield land	Increasing interest by private developers in particular brownfield locations	Emerging interest by private developers in particular brownfield locations
Main constraints	Brownfield land disproportionately concentrated in weaker property markets. Planning, physical and ownership constraints can also be problematic	Brownfield land disproportionately concentrated in weaker property markets. Planning, physical and ownership constraints can also be problematic	Clean-up costs, associated liabilities, financing difficulties and location of brownfield sites in weaker markets	Liability issues, regulatory mechanisms and location of brownfield sites in weaker markets

The first main difference highlighted in Table 4 is a definitional one, with the term 'brownfield' generally reserved for potentially contaminated land in North America in contrast to the broader concept of previously developed land employed in England and Scotland. In North America, the word 'greyfield' has begun to be used to bridge this definitional gap. The overall significance of brownfield land is hard to determine, except in England where official stock figures relative to total land area are most detailed. Nevertheless, it is apparent that in all four countries, deindustrialisation in particular has ensured increasing prominence for brownfield issues in recent years. In the United States, economic redevelopment has been seen as the priority in contrast to the emphasis on residential redevelopment in England and to a lesser extent, in Scotland. Increasing private sector interest is now evident across all four countries, whilst weaker property markets and specific site constraints generally remain important obstacles to be overcome in bringing brownfield land forward for development.

What determines these differences and similarities between the four countries? Three main sets of influences are important here relating respectively to physical, cultural and institutional factors.

In physical terms, the sheer scale of contamination in North America has ensured its importance to policy makers. Although contamination in England and Scotland has been significant enough to demand its own policy and legislative regime, other physical factors such the outworn nature of the urban fabric and associated infrastructure in the many areas where brownfield land is concentrated have required a broader conceptualisation of the policy problem. This has been reinforced by service-sector and administrative restructuring, which has created large brownfield sites (such as former hospitals) with little or no contamination.

Such physical differences are reinforced by cultural values and approaches in each country. North American concern to minimise public intervention in urban property markets have helped concentrate government action on those sites in the worst condition (defined as contaminated) and located in the most problematic areas (such as the cities of the Northeast and Midwest of the United States where contaminated land is matched by high inner-city poverty and racial segregation).

It could be argued that in England, and to a lesser extent in Scotland, the cultural motivation behind brownfield land policy is quite different and originates from a longstanding desire to protect greenfield land and prevent urban sprawl. Interestingly, such environmental motives are now becoming more important in North American land policy, as seen in the recently introduced greenbelt legislation in Canada's Ontario province.

The most important differences, however, are perhaps institutional and are evident in an analysis of the varied roles of the public, private and voluntary sectors in the brownfield redevelopment process. In England, central government has been at the forefront of the brownfield agenda to a greater extent than the devolved government in Scotland and to a much greater extent that the federal administrations in North America. This is apparent in policy directions given to more local levels of government, in the provision of financial assistance and in the development of effective data systems. While federal disinterest in the brownfield agenda has been apparent in Canada, there is greater evidence in the United States of federal support for those at the state level who wish to promote industrial and commercial redevelopment to sustain business and central cities. Nevertheless, despite some early efforts

by the Canadian federal government to track brownfield stocks, little investment has been made in effective national data systems in North America.

In England especially, voluntary and environmental groups have an important impact on the evolution of urban land policy, which is perhaps best demonstrated by the powerful influence of CPRE (the Campaign for the Protection of Rural England) on national planning policy. Such action groups provide a critical connection between the psychological importance of the countryside in English literature, thinking and culture and the articulation of public policy on brownfield redevelopment.

As English land policy has hardened in recent years towards an ever-stronger emphasis on brownfield re-use, so has the private sector in the form of speculative residential developers turning their attention from extensive greenfield estate development towards repairing the urban fabric through the extensive provision especially of new apartments on brownfield sites. Over half of all recent residential development in the UK (and possibly as much as 70%) has been constructed on brownfield sites. Such private sector interest in the implementation of public policy is evident also in the United States, where the original commitment of well-established residential developers specialising in high-density urban projects is increasingly complemented by the diversification of previously greenfield specialists towards the brownfield market.

In a sense, then, this comparison of brownfield redevelopment in Britain and North America both reflects the specific physical, cultural and institutional context of each country and provides a point of entry through which the impact of those particular differences and similarities can be understood in a tangible way. The importance of this for researchers is apparent in the potential of the brownfield agenda on both sides of the Atlantic to act as an equally important vehicle to compare urban land policy as those better-known agendas like urban sprawl and mega-projects.

References

Adair, A., Berry, J., Gibb, K., Hutchison, N., McGreal, S., Poon, J. and Watkins, C. (2004) *Benchmarking Urban Regeneration*, Royal Institution of Chartered Surveyors, London.

Adams, D. (2004) The changing regulatory environment for speculative housebuilding and the construction of core competencies for brownfield development, *Environment and Planning A*, **36**, 601-624.

Adams, D., Disberry, A., Hutchison, N. and Munjoma, T. (2001) Ownership constraints to brownfield redevelopment, *Environment and Planning A*, **33**, 453-477.

Alker, S., Joy, V., Roberts, P. and Smith, N. (2002) The definition of brownfield, *Journal of Environmental Planning and Management*, **43**, 49-69.

Auditor General of Canada (1995) Environment Canada: managing the legacy of hazardous wastes, Chapter 2 in *1995 Report of the Auditor General of Canada*. Auditor General of Canada Ed. Ottawa, Queen's Printer. http://www.oag-bvg.gc.ca

Ball, M., Le Ny, L. and Maginn, P. J. (2003) Synergy in urban regeneration partnerships: property agents' perspectives, *Urban Studies*, **40**, 2239–2253,

Barker, K. (2003) *Review of Housing Supply: Securing our Future Housing Needs – Interim Report – Analysis*, HMSO, London.

Barker, K (2004) *Review of Housing Supply – Delivering Stability: Steering Our Future Housing Needs*, Final Report – Recommendations, ODPM, London

British Urban Regeneration Association (2005) *Delivering in the Growth Area: Overcoming the Barriers to Regeneration*, BURA, London.

Canada Mortgage and Housing Corporation (2004) *Brownfield Redevelopment for Housing: Literature Review and Analysis*, Report prepared by RCI Consulting and Regional Analytics, CMNC, Ottawa.

Contaminated Sites Management Working Group (1997) *Annual Report 1996-1997*, Contaminated Sites Management Working Group, Ottawa

Couch, C. and Fowler, S. (1992) Vacancy and recent structural change in the demand for land in Liverpool, pp. 100-113 in Healey, P., Davoudi, S., O'Toole, M., Tavsanoglu, S. and Usher, D. (eds) *Rebuilding the City*, E & FN Spon, London.

Department for Communities and Local Government (2006a) *Previously-developed land that may be available for development: England 2005 Results from the National Land Use Database of previously-developed land*, DCLG, London.

Department for Communities and Local Government (2006b) *Planning Policy Statement 3: Housing*, DCLG, London.

Department for Communities and Local Government (2006c) *Land Use Change in England: Residential Development to 2005 (LUCS 21)*, DCLG, London.

Department for Communities and Local Government (2007a) *Land Use Change in England: Residential Development to 2006 (LUCS 21 update)* DCLG, London

Department for Communities and Local Government (2007b) *Housebuilding Statistics*, DCLG, London. (Downloaded from http://www.communities.gov.uk/index.asp?id=1156032)

Department of the Environment, Transport and the Regions (1998a) *Planning for the Communities of the Future*, Cm 3885, The Stationery Office, London.

Department of the Environment, Transport and the Regions (2000a) *Planning Policy Guidance 3 (revised): Housing*, The Stationery Office, London.

Department of the Environment, Transport and the Regions (2000b) *Tapping the Potential - Assessing Urban Housing Capacity: Towards Better Practice*, Department of the Environment, Transport and the Regions, London.

De Sousa, C. (2000). Brownfield redevelopment versus greenfield development: A private sector perspective on the costs and risks associated with brownfield redevelopment in the Greater Toronto Area, *Journal of Environmental Planning and Management*, **43**, 831-853.

De Sousa, C. (2006a) Urban Brownfields redevelopment in Canada: The role of local government, *The Canadian Geographer*, **50**, 392-407.

De Sousa, C. (2006b) *Increasing Residential Development Activity on Urban Brownfields: An Examination of Redevelopment Trends, Developer Perceptions, and Future Prospects*. Brownfields Research Consortium working paper prepared for the National Academies HUD Urban Scholars Fellowship Program, Milwaukee.

Dixon, T. (2006) *The Role of the UK Development Industry in Brownfield Regeneration*, SUBR:IM Bulletin 1, Department of Real Estate and Construction, Oxford Brookes University.

Department of the Environment (1992) *The National Survey of Vacant Land in the Urban Areas of England 1990*, HMSO, London.

Department of the Environment (1995a) *Projections of Households in England to 2016*, HMSO, London.

Department of the Environment (1995b) *Our Future Homes: Opportunities, Choice, Responsibility*, Cm 2901, HMSO, London.

English Partnerships (2006) *Urban Regeneration Index 2006*, English Partnerships, London.

Gore, A. and Nicholson, D. (1985) The analysis of public sector land ownership and development, pp. 179-202 in Barrett, S. and Healey, *Land Policy: Problems and Alternatives*, Gower, Aldershot.

Heberle, L. and Wernstedt, K. (2006) Understanding brownfields regeneration in the US, *Local Environment*, **11**, 479-497

Karadimitriou, N. (2005) Changing the way UK cities are built: The shifting urban policy and the adaptation of London's housebuilders, Journal of Housing and the Built Environment, **20**, 271–286

Murdoch, J. (2004) Putting discourse in its place: planning, sustainability and the urban capacity study, *Area*, **36**, 50–58

National Round Table on the Environment and the Economy (NRTEE) (1996) *The Financial Services Sector and Brownfield Redevelopment*, Report prepared by MM Dillon Limited, Global Risk Management Corporation, and Tecsult, National Round Table on the Environment and the Economy, Financial Services Task Force. Ottawa, Ontario.

NRTEE. (1998) *State of the Debate: Greening Canada's Brownfield Sites*, National Round Table on the Environment and the Economy, Ottawa, Ontario.

NRTEE (2003) *Cleaning up the past, building the future: A national brownfield redevelopment strategy for Canada*, NRTEE, Ottawa, Ontario.

Office of the Deputy Prime Minister (2003) *Sustainable Communities: Building for the Future*, ODPM, London.

Office of the Deputy Prime Minister (2005) *Sustainable Communities: Homes for All*, Cm 6424, ODPM, London.

Parliamentary Office of Science and Technology (1998) *A Brown and Pleasant Land*, POST, London.

Scottish Executive (2003) *Scottish Planning Policy 3: Planning for Housing*, Scottish Executive Development Department, Edinburgh.

Scottish Executive (2004) *National Planning Framework for Scotland*, Scottish Executive, Edinburgh.

Scottish Executive (2006) *People and Place: Regeneration Policy Statement*, Scottish Executive, Edinburgh.

Simons, R. (1998) *Turning Brownfields into Greenbacks*, Urban Land Institute, Washington D.C.

Sisson, K. (1989) *Toxic Real Estate* Manual, Wilms and Shier, Toronto.

Scottish Executive (2005) *Scottish Vacant and Derelict Land Survey 2005*, Scottish Executive Development Department, Edinburgh

Syms, P. (2001) *Releasing Brownfields*, Joseph Rowntree Foundation, York.

Urban Task Force (1999) *Towards an Urban Renaissance*, E & F N Spon, London.

US Conference of Mayors (2006) *Recycling America's Land: A National Report on Brownfields Redevelopment, Volume 4*, The United States Conference of Mayors, Washington D.C.

US EPA (2006). *State Brownfields and Voluntary Response Programs - Updated in August 2006*. Washington D.C.: Report by SRA International, Inc., Arlington, Virginia (see http://www.epa.gov/brownfields/pubs/st_res_prog_report.htm)

Wernstedt, K., Heberle, L., Alberini, A., and Meyer, P. (2004) *The Brownfields Phenomenon: Much Ado about Something or the Timing of the Shrewd?* Resources for the Future Discussion Paper 04–46, Washington, D. C.

Williams, K., Burton, E. and Jenks, M. (1996) Achieving the compact city through intensification: an acceptable option? pp.83-96 in Jenks, M., Burton, E. and Williams, K. (eds) *The Compact City: A Sustainable Urban Form?* E & F N Spon, London.

WWF & Insight Investment (2005) *Investing in Sustainability: Progress and Performance among the UK's Listed House-builders Revisited*, Upstream Strategies for Sustainable Futures, London

Yount, K. (2003) What are Brownfields? Finding a Conceptual Definition, *Environmental Practice*, **5**, 25-33.