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The environmental impacts and public costs of unguided informal settlement; the case of Montego Bay

Bruce Ferguson

Summary: *The development of squatter and other informal settlements in Montego Bay (Jamaica) helps individual low-income households (although not the poorest) solve their shelter problem. However, informal settlement also exacts tremendous costs to neighbourhoods and the city as a whole, largely in the form of environmental problems that threaten household health and the region's main economic base, the tourist trade. These environmental costs come in the form of inadequate or no provision for paved roads, piped water, sanitation, and garbage for a high proportion of those living in informal settlements. When these costs are taken into account, informal settlement is no less expensive than formal-sector development. The paper quantifies the costs of providing infrastructure to unguided informal settlement (squatter upgrading) and shows them as comparable to those for government-produced serviced sites and privately produced moderate-income projects - and the infrastructure is often of poorer quality and with less possibility for cost recovery. The paper ends with a discussion of policies that can help solve this problem. Instead of reacting to land invasions, governments should get ahead of low-income housing demand by guiding the development of informal settlements and by lowering the cost of formal-sector production. This strategy promises higher quality housing and infrastructure, lower costs and fewer environmental problems.*

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I. INTRODUCTION

INFORMAL SETTLEMENT LIES at the core of the urban management challenge. Shantytowns and other types of housing created outside the planning process help individual households solve their shelter problem.⁽¹⁾ However, mounting evidence suggests that informal settlements exact tremendous public costs, particularly once they make up a large part of the city; many of these costs are environmental. This paper analyzes these costs

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1. "Informal" settlement has various definitions. Here, it refers to land, infrastructure and shelter development and land invasions that occur outside the land-use planning process and other government rules.

2. The elimination of informal settlement continues in many cities but this approach is typically highly selective. For example, government often evicts squatters from high-value parcels - both public and privately owned - and from hazardous slopes and floodplains in order to avert disasters.

3. Turner, John and R. Fichter (editors) (1972), *Freedom to Build*, New York, Collier Macmillan.

4. Burns, L.S. and L. Grebler (1976), *The Housing of Nations: Analysis and Policy in a Comparative Framework*, Macmillan Publishers, London.

5. Upgrading arguably makes targeting housing programme subsidies easier. If informal settlements contain largely low-income households (an assumption that is often made but infrequently investigated) then benefits from upgrading will mainly reach the poor. In contrast, construction of new solutions risks the filtering of units intended for low-income households to the middle-class and professional households in the absence of a well-functioning household qualification and selection system.

6. Baross, A. and J. van de Linden (1990), *The Transforma-*

and suggests policies to deal with the dilemma using Montego Bay, Jamaica as a case study.

A quick review of government responses to informal settlement helps put the problem in perspective. Informal settlements grew rapidly in many cities in Africa, Asia and Latin America, starting in the 1950s and 1960s. Most governments and municipalities considered these areas "blighted" and tried to remove them through persuasion, relocation housing and bulldozing although this wholesale eradication approach has now largely ended. Authorities have found removal politically impossible now that shantytowns represent a large proportion of urban populations,⁽²⁾ particularly since most governments have failed to offer an alternative.

Starting in the mid-1960s, scholars and practitioners began to recognize the value of informal settlement in solving housing problems and mobilizing resources to invest in urban development. Based on his work in Lima's squatter settlements, John Turner and others built the case that shantytowns were an adapted, appropriate housing solution for the poor.⁽³⁾ "Self-help" and "informal housing" were seen as harnessing the energies of the poor to solve their own shelter problems. The World Bank and a few other large donors followed suit in the 1970s, although many smaller donors did not. Squatter upgrading projects became one of their main urban policy responses.

Many governments have shown more reluctance to support upgrading programmes than the World Bank and other large international agencies. Often, influential groups have divided sharply over whether to promote "new development" (complete units, progressive units and serviced sites) or squatter upgrading. The construction industry and financial institutions typically support new development which they end up building and financing. Politicians have often fluctuated between supporting new solutions - which provide photo opportunities as projects are begun or completed - and organizing squatter invasions and some investment in squatter communities at election time which also produces votes. Many housing experts and social reformers have supported squatter upgrading for a number of reasons. Perhaps, foremost, squatter upgrading has appeared to offer a more economical "second-best" solution than new solutions.⁽⁴⁾ In addition, the growing size of the informal settlement, often 30 to 60 per cent of cities, demands attention.⁽⁵⁾

Crucial difficulties, however, have arisen with the reliance on the informal sector to build most shelter and, hence, occupy much of the land area of cities. By the 1980s, many cities had started running out of land well-suited to informal settlement.⁽⁶⁾ Two decades ago, the poor could often find relatively centrally located parcels to occupy; now, typically, they cannot.

Two consequences have followed from the lack of urban land suitable for informal settlement. Both have had highly negative impacts on the urban environment. First, population densities in existing, centrally located informal settlements have increased dramatically. These higher densities overwhelm existing infrastructure capacity (groundwater, leach pits, sewer plant processing capacity, roads, etc.) that had adequately served smaller and less dense populations.⁽⁷⁾

tion of Land Supply Systems in Third World Cities, Avebury Publications, London; also Doebele, William (1987), Chapter 5: "Land policy" in Rodwin, Lloyd (editor), *Shelter, Settlement & Development*, Allen and Unwin Publishers, Boston, pages 110-132.

7. Improper sanitation that contaminates sources of drinking water appears to be the single greatest environmental and health threat in these centrally located informal settlements. Water related diseases are among the leading causes of death in most countries in Africa, Asia and Latin America. Most of these deaths stem from bacteria and viruses that spread through the environment due in large part to inadequate sanitation and water treatment. In addition, toxic chemicals produce various long-term illnesses. Pollutants such as untreated sewage also degrade the natural environment.

8. For example, the uncontrolled expansion of urban settlement together with reliance on the automobile and cheap low-grade leaded fuels has inflicted the worst air pollution in the world on cities in Asia. For example, in a World Health Organization/United Nations Environmental Programme study, all ten of the cities with the highest suspended particulate matter were Asian - see G.T. Kingsley, B.W. Ferguson, D.T. Bower with S.R. Dice (1994), *Managing Urban Environmental Quality in Asia*, World Bank Technical Paper No 220, Washington DC.

9. Two factors are most important. First, the city is a coastal resort town and depends on a tropical marine environment of good beaches and coral reefs to attract tourists. Second, the terrain of a large part of the settled area of the city is hilly. Although somewhat distinctive, these features are shared by many other cities in low and middle income countries. Here, informal settlement has filled the most environmentally sensitive areas, such as

Second, new informal settlement often occurs on sites that are inappropriate for one or more reasons. Great distance from city centres causes long commutes, generating many individual and public costs including ambient air pollution from vehicle emissions.⁽⁸⁾ Location far from existing infrastructure lines raises the costs of infrastructure extension. Informal settlements threaten environmentally sensitive areas (aquifers, forests, wetlands and other bodies of water). Settlements built on steep slopes greatly increase the costs of infrastructure provision and sometimes threaten residents' safety because of mud and land slides. Thus, informal settlement helps solve the individual household's shelter problem but creates great environmental impacts and public costs, often borne by government.

These drawbacks have renewed policymakers' awareness that informal settlement causes great problems as well as representing a solution. Informal settlement provides a means for individual households to gain shelter but at great public cost, much of it deriving from negative environmental impacts. The return to "problem" is more than just a change in attitude on the part of donors and governments. The smaller informal settlements of the 1950s and 1960s represented a more adapted urban housing solution than the immense shantytowns that now make up large portions of many cities in emerging countries.

This paper quantifies and compares the cost of providing urban services to informal sector development with that of formal sector development. Squatter upgrading projects are the informal sector solution analyzed. Government serviced site projects and private sector moderate-income projects are the formal solutions examined. A large part of the appeal of squatter upgrading rests on the hypothesis of lower cost - that upgrading is more economical than new solutions such as a serviced site. If, in fact, upgrading costs the same or more than new solutions, its attraction fades, with ensuing implications for housing programmes and policies.

Montego Bay is used as an illustrative case to test this hypothesis. Although Montego Bay, like all urban areas, has a specific environmental and economic context,⁽⁹⁾ the settlement and cost patterns that emerge are similar to those of other cities in Latin America and the Caribbean - and also in Asia and Africa. Self-help provision of roads, water, sanitation and electricity occurs as it does in Montego Bay throughout these regions, with modest local variations. The most fundamental conclusion, namely that unguided informal settlements generate great public costs incompatible with effective urban management, is a crucial problem shared by low and medium-income countries in Latin American and the Caribbean, Asia and Africa. This paper seeks to carefully document the self-help provision of urban services and quantify the resulting public costs.

The paper concludes by exploring solutions to the public costs of informal settlement in Montego Bay and elsewhere. In general, the approach with the best potential is to "formalize" informal land development, to "informalize" formal development and to involve the private sector in implementing housing and infrastructure projects.⁽¹⁰⁾ This approach differs from the settlement

surrounding hillsides and lowlands. Natural attractions such as good beaches and coral reefs also make an important contribution to the economies of many cities including most of the cities in the Caribbean and many of those on the coasts throughout Latin America, Africa, and Asia.

10. See reference 6, Baross and van del Linden (1990).

policies of many governments. Current practice often fluctuates between producing a few high-cost, highly subsidized new units (often for the middle-class) and squatter upgrading, which fails to get ahead of demand and provokes land invasions.

Data collection included extensive interviewing, housing project cost analysis and household surveys on infrastructure provision, development costs and informal settlement in Montego Bay.⁽¹¹⁾ In particular, data were assembled on nine communities with varying degrees of informal settlement within Greater Montego Bay in order to test hypotheses on the public costs and

Box 1: Nine Communities in Montego Bay

The nine communities which underwent in-depth examination for this paper consist of three informal sector areas (Flankers, Norwood, and Rosemount), three mixed informal/formal sector ones (Pitfour/Granville, Salt Spring, and Mount Salem) and three formal sector ones (Catherine Hall, Catherine Mount, and Farm Heights).

Informal sector communities. Flankers - located 3.5 miles (c. 5.6 km) from the central business district - has been settled by successive waves of squatting. Following the refusal of a court to evict squatters, government gradually installed infrastructure. Flankers has a reputation as a criminal enclave. Old Norwood developed through squatter land-capturing on land owned by a private company, which then sold this land to the Ministry of Construction (Housing). For a number of years, government has attempted to guide development of over 3,000 lots in a new area, New Norwood, and has recently built 300 finished dwellings measuring 500 square feet (c. 46 square metres) and sold at US\$ 16,000 each. Rosemount land was originally in private ownership; it was then transferred to the Ministry of Construction after squatting began, and the latter has provided 600 finished units and upgrading on 26 acres which are now occupied by squatters.

Mixed communities. Pitfour/Granville is one of the area's fastest growing communities. Three formal sector sub-divisions were completed in 1969, 1975 and 1984. The Ministry of Construction has built more than 300 homes and squatter-capturing takes place on the remaining land that remains unsubdivided. Salt Spring is old, dating from the nineteenth century. Informal settlement began 40 years ago and accelerated in the 1970s and 1980s. Small landowners have accommodated waves of newcomers by creating house spots (illegally subdividing parcels into micro-parcels). Mount Salem - located only one mile (c. 1.6 km) from the central business district - was settled by poor rural migrants who crowded into high-density house spots in its central area where they share communal toilets, kitchen and bathing facilities. The Ministry of Construction (Housing) has built 200 units in a newer part of this community.

Formal sector communities. Catherine Hall/Catherine Mount was designed as a sites and services project with World Bank funding, but was converted into a "starter-home" project in 1981. Lots are very small but infrastructure is ample. Farm Heights - located two miles (c. 3.2 km) from the central business district - was developed by the Ministry of Construction in three phases for occupancy in 1978, 1982, and 1983 on land donated by a church. Standard 500 square feet dwellings are served by water, electricity and absorption pits.

11. The research for this paper was sponsored by the United States Agency for International Development. It resulted in a report that covers this and other issues: see Peterson, George and Bruce Ferguson with O. Cuffe (1993), *Formal vs. Informal Housing: A Comparison of Public and Private Costs in Montego Bay and Negril*, The Urban Institute, Washington DC, 139 pages.

12. Earnings from tourism in Montego Bay totalled about US \$275 million in 1992 which is approximately one-third of the total foreign exchange generated by tourism in Jamaica.

13. O'Callaghan Consulting Services (1992), *Greater Montego Bay Redevelopment Company, Environmental Report*, O'Callaghan Consulting Services, Montego Bay, Jamaica, 122 pages.

14. The informal settlements can be divided into three types in Montego Bay: tenement yards, established squatter settlements and emerging squatter settlements - see Peterson, Ferguson with Cuffe 1993 in note 11.

15. Planning Institute of Jamaica (PIOJ) and the Statistical Institute of Jamaica (STATIN) (1992), *Survey of Living Conditions Report 1991*, Kingston, Jamaica, 86 pages.

16. With the passage of time and provision of infrastructure, households in squatter settled areas are likely to stop identifying their community as a "squatter" settlement. Jamaican law has provisions that those who capture land develop rights to ownership as time passes. *De facto* ownership can be made legitimate if the occupier can provide sufficient proof that he or she has occupied the land rent-free for at least 12 consecutive years. Even without correcting for the effects of law and squatter upgrading, however, the official figures for squatting (10 per cent and less) appear low. In Montego

environmental risks caused by unguided informal settlement. Three of these communities are formal sector, three are mixed, characterized by both informal and formal settlement, three are predominantly informal; see Box 1 for a brief description.

II. THE CONTEXT OF INFORMAL SETTLEMENT IN MONTEGO BAY

THE POPULATION OF Montego Bay has grown fast relative to other cities in Jamaica. Between 1982 and 1991, Montego Bay expanded at an annual rate of 2 per cent, compared to 0.88 per cent for Jamaica as a whole. The city's expanding economy, dominated by tourism,⁽¹²⁾ has driven this population growth. In addition, manufacturing - much of it located in Montego Bay's free zone where 18 firms employ 4,132 people - has diversified the local economy.

Montego Bay lies on a narrow coastal plain alongside a well-protected bay, dissected by the North and South Gullies and the Montego, Retirement and Pies Rivers. Steep hills rise to the north, south and east of the central area of the city and the ocean lies to the west.

The Montego Bay area is the drainage basin of the Montego River and can be divided in three physical areas.⁽¹³⁾ Furthest inland is a dense network of valleys and ridges with dendritic drainage patterns and elevations. The central portion of the basin is occupied by limestone areas and has a rugged topography with slopes reaching 1,750 feet above sea level. Coastal lowlands, including the floodplain of the Montego River, consist of fluvial sediment up to a depth of 230 feet and extend from the foot of the limestone hills as far as the sea.

Historically, Montego Bay developed as a locus of sugar cultivation and export. Government made large grants of the flat arable land in the region for sugar cultivation and still owns much of the hills surrounding the city. Formal sector development - primarily upper-income residential and commercial - has replaced sugar cultivation in the flat coastal lowlands up and down the coast to the north-east and south-west of the city. Squatters have occupied much of the hills, of the land in public ownership and private lands with little agricultural value.

III. THE PROCESS OF INFORMAL SETTLEMENT

INFORMAL SECTOR HOUSING takes various forms.⁽¹⁴⁾ In many Jamaican urban areas such as Kingston, most informal sector households lease rooms ("apartments") in dense existing settlements. These areas are called "house spots" or "tenement yards". Their location ranges from the centre to the periphery of urban areas.

Squatting is less common. The Planning Institute of Jamaica indicates that only 10 per cent of households identified their housing solution as squatting.⁽¹⁵⁾ However, these, and lower figures derived from household surveys, probably underestimate

Bay, for example, the communities of Norwood and Rosemount - which are primarily squatter areas - account for over 20 per cent of the population, while many other squatted areas also exist.

17. See Peterson, Ferguson and Cuffe 1993 in note 11.

18. This picture of urban squatting in Jamaica emerged from many interviews for this study. It is also reflected in Gordon, Diane (1990), *Rural Housing Policy in Jamaica: Dimensions in Rural Development and Planning*, Masters Thesis, University of Guelph, School of Rural Planning and Development, Guelph, Canada, 238 pages.

19. Variations of this theme characterize different urban areas. In Kingston, the competition for land is so intense that many would-be squatters must wait for a previous occupant of a site to move out and there are long waiting lines for squatting. In the meantime, many of these would-be squatters must live in the squalid conditions of Kingston's tenement yards while others are forced to occupy river beds and gullies.

20. Data from Peterson, Ferguson and Cuffe 1993 (see note 11) bear out this view. Levels of dissatisfaction with living conditions are very high (92.2 and 70.5 per cent) in the two tenement yard communities surveyed, exceeding that of any other type of informal sector settlement. Tenement yards have a lower proportion of permanent (block and steel) building materials than other types of informal settlement. Overall, the condition of tenement yards is poorer.

the share of squatting in existing settlement.⁽¹⁶⁾

Although most informal sector households are not officially squatters, squatting represents the main means of informal sector land development. Hence, it has central importance in an examination of the costs and benefits of development by the informal sector.

Other studies and interviews for this study confirm that the guiding principle for squatting is to maximize the chances of remaining on the land once it is "captured".⁽¹⁷⁾ Other goals, such as access to employment and to infrastructure lines, have some importance but far less than permanency on the land.

Squatters use many strategies to stay on captured land.⁽¹⁸⁾ In considering where to squat, they select land from which eviction seems less likely. Once they occupy a piece of land, they must continue, physically, to hold it. Often, squatters construct a temporary dwelling from second-hand materials, sometimes overnight. They then get a friend or relative to live in this temporary dwelling and use it as the shell from which to begin construction of a more permanent structure, into which they will move as soon as its physical condition permits.

Squatters negotiate with landowners and lobby politicians to remain on the "captured" land or to exchange their current site for another. If the land has been laid out for a government developed sub-division - as parts of Norwood and Rosemount in Montego Bay have - they typically build within the pegs to avoid destruction of their houses (which might lie in the future roadway of an upgrading scheme) and to avoid problems with land titling.⁽¹⁹⁾

Once residents obtain improvements from government or reach an agreement with a private landowner, the community becomes more permanent. A virtuous circle of improvements begins, often resulting in formally provided water, electricity, roads and land titles for residents in exchange for a nominal sum of money paid to the upgrading government agency. Even before this point is reached, residents typically no longer consider themselves as squatters. If the squatted area receives no tacit agreement of permanence or infrastructure improvements, it remains in limbo and conditions tend to deteriorate rather than improve.

Thus, squatting represents a gamble and requires some accumulated capital and other resources with which to bet - money for building materials, friends or relatives to help hold the land and contacts with government officials and others. The resource requirements of squatting usually exceed the means of the poorest households. The poorest households in Montego Bay often rent house spots on privately owned land whose owners allow unplanned and unregulated construction or rooms ("apartments") in these houses.⁽²⁰⁾ These tenement yards - common in older low-income communities where land has long been in private hands such as Mount Salem, Salt Spring and Long Acres in Montego Bay - produce the densest and worst conditions in the region with the greatest negative environmental impact.

Government and large private landowners largely set the parameters within which squatters take their gamble. Foremost in importance, lack of government action makes squatting easi-

est on government owned land. Government developers such as the Ministry of Construction (Housing) and the Urban Development Corporation face substantial political difficulties in evicting squatters. From 1950 through the 1970s, government developers forcibly removed squatters. Now, they cannot remove sizeable squatter communities although handfuls of squatter households are sometimes displaced. Largely as a result of this, squatters have occupied to some extent all of the largest government owned parcels in Montego Bay.

This process of squatter capturing of government land now follows a pattern in Montego Bay and elsewhere in Jamaica. A government agency will plan a serviced site or core unit project. Sometimes, the land is surveyed and pegs marking lots are laid out. However, squatters capture the land during delays in project implementation.

Government agencies have reacted largely in one of two ways. If squatters are stopping a key project from going ahead, these agencies usually attempt to negotiate with squatters to relocate them to a different piece of land. Otherwise, the squatters remain. As the squatter community residents build and improve, they may eventually succeed in gaining sufficient "voice" to attract infrastructure investments in the form of government upgrading schemes.

Although government land is an easier target for capturing, squatters also attempt to occupy privately owned land, particularly when adjacent to existing squatter communities. Private owners have responded in three ways. Occasionally, they abandon the land. Otherwise, they either go through the courts to evict squatters forcibly or, particularly if the land is of low value, they offer to sell it to the government. At times, landowners appear to have indirectly collaborated with would-be squatters to capture their low value land and promote its sale to the government for upgrading schemes.

As in other countries, low formal sector production generates the pressures for squatting. In Jamaica, with a population of roughly 3 million, government and private sector developers together typically produce less than 1,000 units per year. High costs, high subsidy levels, concentration of urban land ownership and restrictions on urban land supply play important roles in causing this low production.

IV. SELF-HELP INFRASTRUCTURE, ENVIRONMENTAL IMPACTS AND UPGRADING OF INFORMAL SETTLEMENTS

SQUATTING HELPS INDIVIDUAL households resolve their shelter problems in Montego Bay but at considerable public cost, much of it environmental. The problems with infrastructure extension to informal sector communities generate many of these public costs. Local government might be expected to take a lead role in planning, urban services and housing and to mediate between government developers, private sector developers and households. However, the St. James Parish Council - which

Box 2: The Weakness of the Local Authorities

From the mid-nineteenth century to the 1950s, the St. James Parish Council was responsible for urban services, in general, in Montego Bay. Over the last four decades, it - like other parish councils in Jamaica - has lost responsibility for urban water and sewer systems to the National Water Commission, for electrical provision to Jamaica Power Service, much planning authority to the Town and Country Planning Department, and main roads to the Ministry of Public Works.

As a result, the St. James Parish Council has also lost many sources of income. It collects and receives extremely little revenue, totalling about US\$ 800,000 in 1992 or about US\$ 7.00 per person. Eighty-five per cent of this total comes from transfers from central government. Of this revenue, 25 per cent goes to wages, salaries and pensions, 50 per cent to street lighting fees paid to the Jamaica Power Service and most of the remainder to maintaining parish council buildings. Virtually no funds exist for new infrastructure investment except for street lighting. Central government agencies and organizations have responsibility for water, sewers, electricity and solid waste. Although these agencies have invested considerable sums in Montego Bay - a prime tourist area and generator of foreign exchange - they have neither a mandate nor a vision for the area that succeeds in reconciling development with the preservation of the environment.

has jurisdiction over Montego Bay - and other Jamaican local governments lack the power and resources for these tasks which national infrastructure supply agencies have assumed - see Box 2.

A detailed picture of infrastructure and urban service provision is necessary to appreciate these public costs. This section describes squatter self-help provision of these services, the environmental impacts of self-help provision and the squatter upgrading process. The services examined are roads, electricity, sanitation and solid waste. In addition, density, a critical factor underlying these services, is discussed.

Many of the details and the overall picture that emerges of squatting and upgrading are shared throughout the South and will be familiar to practitioners and students of informal sector housing and the urban environment. This picture is particularly accurate for squatter communities on hilly terrain such as the bulk of those in Montego Bay.

a. Roads

Part or all of most newly settled squatter communities typically lack a road network. Forty-nine per cent of the area of the informal settlements sampled lacked direct road access. The

sub-division process applied to formal sector communities provides for roads, rights of way and public spaces. In contrast, squatter households lay claim to as much area as they can without leaving room for roads and public spaces. After an area is first captured, residents wear footpaths that wind in between the houses within the community. The few existing roads twist in between houses, are unpaved and, often, become impassable during and after rains. A number of dirt roads are also likely to be worn down between the area of the settlement and the nearest arterial road.

If the settlement receives some political attention and investment, the road network is likely to be rationalized. A government agency will straighten and pave a few key roads. One of the dirt roads in between the settlement and the nearest arterial road will be paved, providing better access to the community. The Parish Council may begin to maintain this access road. However, many footpaths and unpaved minor roads are likely to continue to wind through the community and remain unmaintained.⁽²¹⁾

21. The exception to this process occurs when squatters occupy an area where government has already pegged (platted) with the intent of developing a housing project. Here, squatters often stay within the pegged lots and avoid space marked for roadways.

If the community benefits from an overall upgrading scheme, these efforts will be more comprehensive. A government developer will take aerial photographs and will plan the lay-out of the community. The agency will straighten and pave as many roads as possible within the community and will relocate houses that are in the way. However, if the squatter community takes control and fails to get political legitimacy, roads are likely to remain in much the same condition as when the community initially settled, that is, unpaved and twisting and other improvements become less likely.

As Table 1 shows, road coverage within settlements increases strongly with formality. Fifty-one per cent of the households in

Table 1: Key Infrastructure Indicators in Nine Sample Communities

Type of community	% of households with direct access to roads	% of households with individual water connections	% of households with garbage collected	% of households with leach pits or no sanitation
Informal ^(a)	51	66	61	93
Mixed ^(b)	63	92	72	70
Formal ^(c)	100	100	91	19

SOURCES: Interviews with infrastructure supply agencies and St. James Parish Council.

a. Norwood, Rosemount and Flankers.

b. Pittfour/Granville, Salt Spring and Mount Salem.

c. Catherine Hall, Catherine Mount and Farm Heights.

the informal sector communities, 63 per cent in the mixed communities, and 100 per cent in the formal sector communities had direct access to roads.

Road condition correlates well with the resources of the agency maintaining it. Many roads maintained by the Parish Council - which has extremely limited funding - are in poor condition as they receive virtually no maintenance. In contrast, roads main-

22. For example, the national Department of Public Works and the Ministry of Construction (Housing).

23. Typically, the carriageway of paved roads in upgrade schemes is 16 feet (c. 4.9 metres) compared to 19-20 feet for serviced sites (c. 5.8-6.1 metres) and 20-30 feet (c. 6.1-9.1 metres) for private sector sub-divisions. Curb walls are built only in essential locations where erosion and drainage problems demand it, compared with formal sector sub-divisions where curbs run throughout the development. The material of upgraded informal sector roads is likely to be of the lowest quality, typically spray-on-chip. In contrast, formal sector sub-division roads are likely to be of a marl limestone base and stone or asphalt on top.

24. High densities alone need not cause environmental problems. Many high-class, residential areas of European cities have densities of 40 households per acre. However, the infrastructure and services enjoyed by these households make the environmental quality high.

25. See Kingsley, Ferguson, Bower and Dice 1994, quoted in note 8.

tained by central government agencies⁽²²⁾ are in fair or good condition.

The lack of a road network plays a fundamental role in increasing the public costs of squatting. A lack of road access makes the provision of urban services vital to health and safety difficult and costly. Installing water and sewer lines, which typically run beneath or along roads, often becomes prohibitively expensive. Police and garbage vehicles face great difficulty entering many areas. As a result, communities tend to have poor or no garbage collection and risk becoming criminal enclaves. The lack of roads also greatly increases the cost of upgrading. Large numbers of squatter houses - between 10 and 40 per cent of squatter communities - must be relocated and, often, reimbursed to make way for roads. Relocation is both costly and politically difficult.

Generally, the road network that results from squatter upgrading projects is inferior to that of formal sector communities. It often fails to give direct access to a substantial number of households, which have access to roads only from footpaths, and is built to lower standards.⁽²³⁾

b. Density

Informal sector developments have a wide range of densities although most are typically much denser than formal sector developments because squatters leave no or little room for roads and public facilities. Tenement yards, such as those in Mount Salem, often shelter 40 households per acre (c. 100 per hectare). Density in emerging squatter settlements nearer the city centre, such as Norwood and Rosemount, is about 10 to 12 units per acre (c. 25-30 units per hectare). Squatters in areas on the urban fringe, such as Farm Heights, often have much bigger lots producing densities typical of formal sector development, namely three to five units per acre.

The high density in informal settlements lacking adequate infrastructure plays a fundamental factor in environmental and health conditions.⁽²⁴⁾ In particular, high densities make low-cost sanitation, i.e. non-sewer sanitation, environmentally hazardous. International experience has shown that non-sewer sanitation solutions begin to seriously threaten residents' health and the environment when densities exceed 40-60 persons per acre (100-150 persons per hectare) given typical soil conditions.⁽²⁵⁾ High densities also reduce light and air, often leading to skin and respiratory problems.

The densest settlements in Montego Bay (the tenement yards) far exceed this density and have few pit latrines thus creating the worst health conditions in the area. Initially, the lots were sub-divided and the structures constructed in accordance with land-use and building regulations. With increased urbanization and population pressures, however, owners further sub-divided these lots and divided structures into many units in order to rent to new residents. This unregulated division of land and structures for rental occupancy has produced densities of 40 households per acre (c. 100 per hectare). The densi-

ties in tenement yards far exceed those of most squatter settlements which typically have around 10 households per acre (25 per hectare). Without sewers, the extreme densities in tenement yards directly increase environmental and health risks. The residents of tenement yards tend to be the poorest of the poor, those who lack the resources to squat.

Upgrading projects typically reduce densities somewhat, through relocation of 10-40 per cent of existing households to make room for roads and community facilities. However, densities in upgrading projects - often around 10 households per acre (c. 25 per hectare) - customarily still far exceed those of formal sector development which range from three to six households per acre (7.5 to 15 per hectare).

c. Electricity

Electricity is the most "democratic" urban service. Virtually all informal sector households are connected to electricity lines, many clandestinely. Often, residents use a pole of bamboo to place a metal hook attached to a wire over the electricity line. This high-risk procedure can result in electrocution. Alternatively, households hire a local person with some technical knowledge for this task and for wiring inside their homes.

When an area lacks electricity, residents must run wires over the ground to the nearest useable electricity line. These wires run on the surface of the ground, over open fields and are highly dangerous.⁽²⁶⁾

The quality of electricity from these connections varies widely but is often far below formal sector standards. In comparison with the 110 volts received by formal sector users, many informal sector users obtain 70-90 volts. This energy is sufficient for lighting but not for operating a refrigerator or other large or sophisticated electrical equipment.

As with other services, informal sector settlements sometimes graduate to an official electricity service through political pressure. A member of Parliament with an interest in the area acquires funds for this purpose and approaches the electricity company, Jamaica Power Service, to extend power and distribution lines.

d. Water Supply

Formal sector developments in Montego Bay have individual water connections provided by the National Water Commission, the central government agency in charge of water and sewer systems in urban areas. Overall, Montego Bay's water supply is ample and greater than demand although some problems exist with low water pressure. About 90 per cent of households in Montego Bay - as elsewhere in Jamaica - have access to good piped water for drinking. Widespread access to good drinking water has largely saved informal settlements from the worst health consequences of inadequate sanitation although this may not be the case in the future.

Once informal sector communities become established, the

26. Until recently, residents of informal sector communities without electricity could come within 300 feet (c. 91 metres) of a useable Jamaica Power Service line, install a pole and obtain a meter and a legitimate connection. This practice has resulted in forests of poles with meters clustered at the point nearest many informal settlements. Currently, legal problems often block the Jamaica Power Service from allowing this practice to continue.

27. Typically, squatters use two-inch (in diameter) pipe (usually PVC but occasionally galvanized iron) for the distribution lines, whilst the NWC uses four to six-inch galvanized iron pipe. Informal sector households bury their pipe six inches to one foot below the surface rather than one to two feet as does the NWC. They also do not examine elevations or install meters whereas the NWC does both. Both the NWC and squatter connections to individual households are done with half-inch PVC pipe. (There are 2.54 cm to an inch).

28. NWC's policies lie behind some of the widespread illegal water connections. Historically, the NWC has required proof of landownership for connection. Without ownership, households have no means of approaching the NWC. The latter is in the process of changing the law to allow it to provide water to squatters on government land and to households that receive verbal permission for water connection from the private landowner.

29. Infant mortality in Jamaican urban areas averages 22 per 1,000 live births compared to nine in New York City (for all five boroughs although some neighbourhoods have much higher rates) and 120 in Recife, Brazil.

30. Although the current supply (31.1 million cubic metres - mcm/year) far exceeds existing demand (22.1 mcm/year), the NWC projects a shortfall after the year 2000. Two proposals have been developed to meet the expected shortfall: first, the Great River Water Supply Scheme - now commissioned - which will supply 10 million imperial gallons per day with the capacity for further expansion; and second, the Queen of Spain Aquifer Recharge System which is still in the planning stage. Both these projects will invest large sums to bring water from distant sources.

great bulk of residents typically get access to piped water often clandestinely and for free. More than 80 per cent of households in the informal sector communities which were examined in depth in this study had access to piped water although a much lower percentage enjoyed individual connections. Typically, groups of households join together to share the cost of running lines and connecting pipes to the nearest National Water Commission (NWC) distribution line. Their standards for connection and pipe size are lower than those of the NWC.⁽²⁷⁾

As a settlement gains permanence and political influence, pressure from squatter demands results in members of Parliament or others interceding with funds to finance NWC connections. Squatter settlements sometimes get these extensions free. The NWC builds new lines and when these are connected to the settlements and their households, the NWC cuts the clandestine distribution lines. For water as well as sewer and electrical connections, most of the trunk lines are installed by the central government infrastructure provision agency - the NWC or the Jamaica Power Service - based on plans for system wide improvements. In contrast, most of the official distribution and service lines to informal sector communities are the result of political pressure and, thus, are often free.⁽²⁸⁾

Widespread access to piped water of a reasonable quality has partly protected informal settlement residents from poor sanitation and solid waste problems. Probably for this reason, infant mortality rates remain modest in Jamaica's urban areas.⁽²⁹⁾ However, water provision also suffers from problems that present environmental and health dangers and, in newly formed squatter settlements where great distance from distribution lines or difficult terrain make extending pipes difficult, households often bring water in or buy it from vendors at exorbitant cost.

The result of lower standards is that the service from informal sector distribution lines is far poorer than that from the NWC. Water often comes out in a trickle. The small amounts of piped water available to households make waterborne sanitation unfeasible and families must rely on leach pits which, on impermeable soils, are often the most damaging form of sanitation for health and the environment. Water volume, in addition to water quality, is critically important in improving health conditions. Generally, small volumes make washing, cooking, showers and cleanliness difficult.

Leakage and theft contribute to very high rates of unaccounted for water in Montego Bay, about 70 per cent of the total. Thirty per cent is lost through leakage and about 40 per cent is stolen. This high proportion of unaccounted for water generates potentially huge infrastructure costs in the form of system expansion. Instead of generating water from conservation - a relatively low cost alternative - the NWC has plans to invest large sums to bring water from distant sources to meet growing demand.⁽³⁰⁾

Not surprisingly, then, the quality of access to piped water tends to increase with formality. The best indicator of access - the percentage of households with individual connections - increases from an average 66 per cent for the three informal sec-

tor communities in the sample, to 92 per cent for mixed communities and to 100 per cent for formal sector communities (see Table 1).

e. Sanitation

The existing sewer lines collect less than one-third of the total sewage generated by Montego Bay and fail to process even this waste water adequately. The existing Montego Bay Sewage Treatment Plant was constructed in the early 1960s. The design provided for secondary waste water treatment up to the plant's capacity of 0.72 million gallons per day. Currently, the plant is far overloaded, handling a flow up to 3 million gallons per day. The plant has experienced numerous problems over the years. The most serious comes from operating the plant at two to three times its original design capacity. This overload has sometimes caused raw sewage to bypass treatment, has caused equipment breakdown and a loss of efficiency. Formal sector households, in particular, typically enjoy waterborne sewers. All formal sector communities in the sample had access to sewers.

Two-thirds of the population of Montego Bay (16,000 households), many in informal settlements, rely on pit latrines and septic tank systems or have no sanitation. The densest settlements in Montego Bay often have only a few pit latrines to serve residents. Public health authorities also indicate that many informal settlement residents who say they have pit latrines have, in fact, no access to any sanitation facility. Informal sector residents who have no sanitation facilities - possibly 5-10 per cent of the total population - put their faeces in plastic bags and throw these bags into nearby gullies or bushes.

The least satisfactory sanitation solutions, leach pits or no sanitation facilities, are much more common in informal and mixed communities than formal sector ones. In the informal sector communities studied, 93 per cent of households disposed of waste water in leach pits or had no provision for sanitation - with the comparable figure for mixed communities being 70 per cent and only 19 per cent in the formal sector communities (see Table 1).

The great bulk of residents of low-income informal settlements typically say that they use "pit latrines". Often, pit latrines are little more than holes in the ground about three to five feet deep. Aerobic bacteria break down waste water in these holes to some extent. Pit latrines fill up over varying periods depending on their depth and soil conditions. Then, households often dig a new hole on a different part of the property.⁽³¹⁾

Poor sanitation and the waste water discharged by Montego Bay's 16,000 informal sector households produces the greatest direct threat to the environment and to human health. Poorly treated sewage from the existing sewer plant and waste water from leach pits are the greatest source of bacteriological pollution and high nutrient levels in Montego Bay.⁽³²⁾ This pollution is destroying Montego Bay's main economic resources, namely its beaches and coral reefs. Limited measurements of bacteriological contamination show faecal coliform levels exceeding the standard for recreational use in three out of seven beaches.⁽³³⁾

31. When running water is available in sufficient quantities - a rarity in informal settlements - households sometimes use soak-away pits or "septic tanks". If properly constructed, they are dug eight to 12 feet deep down to permeable soil, are eight to ten feet in diameter and are lined with hand-packed stone rubble. A concrete slab with a removable manhole cover forms the top. A toilet then flushes waste water through a pipe into this pit and anaerobic bacteria work on the effluent. Soak-away pits must be de-sludged, on average, about every two to four years.

32. Overloading the Montego Bay sewer plant results in dumping effluent into the sea that has higher than acceptable bacterial counts and high nitrate and phosphate levels. This plant was designed to eliminate 89 per cent of Biological Oxygen Demand (BOD) and 98 per cent of suspended solids from effluent. It is succeeding in removing only 70 per cent of BOD and 75 per cent of suspended solids. Package sewer plants exacerbate these problems. Some of the large hotels in Montego Bay have such plants and their operation has proved problematic. The older ones, in particular, discharge far lower quality effluent than the public sewer plant.

33. Exceeding 200 mph/100 ml.

34. See reference 13.

35. Only seven inspectors now exist for 156,000 people in St. James' Parish.

A marine park development report⁽³⁴⁾ notes that the coral reefs directly offshore are "...badly degraded and over-exploited in the areas most used as tourist attractions and near shallow water fishing grounds."

The limestone base rock of the central, hilly area of Montego Bay complicates the problem. This bedrock is often highly permeable and allows rapid infiltration. Waste water seeps through its many crevices and stays absorbed over long periods of time, gradually percolating into the sea. Thus, even if immediate measures were taken, waste water would continue to discharge into the sea for many years to come.

The St. James Parish Department of Public Health has nominal responsibility over non-sewer sanitation practices. Fifteen years ago when squatter settlements were small, staff walked through these communities instructing residents on health practices including appropriate methods for constructing pit latrines. However, the agency's staff has failed to match the large population increase in informal settlements and, consequently, now mainly responds to complaints and has stopped outreach - a pattern common to other large Jamaican urban areas.⁽³⁵⁾

Public health authorities indicate that only luck has prevented epidemics of diseases such as cholera and typhoid and that one or two individuals contaminated with these diseases could cause a spread. Outbreaks of gastroenteritis and conjunctivitis already afflict Montego Bay's informal sector communities, particularly in children under the age of two.

A proposed extension and improvement of Montego Bay's sewer system, scheduled to start in 1995-96, represents the main hope for relieving the environmental and health dangers of waste water. If and when this expansion is completed, it is meant to be capable of treating waste water generated by all of Montego Bay's population, projected to the year 2020.

However, two problems may block this outcome. First, individual households must pay for connection to the sewer system. The cost of connection, about US \$200, exceeds the capacity or willingness to pay of many. Second, the collection system will fall far short of reaching many households. As currently designed, the system mainly serves central areas and leaves out many important existing informal settlements in the hills above the Montego Valley and in the coastal area because of the cost of extension to areas with steep terrain and hard soil. In addition to incomplete coverage of existing informal settlements, the system will also fail to cover most new informal settlements that are bound to develop.

Sanitation has become a crucial issue for squatter upgrading schemes. Until the last decade, many squatter upgrading schemes in Jamaica and elsewhere failed to include a sanitation solution. Although upgrading schemes provided water, they offered no means of dealing with waste water. Once contaminated, the water brought in by upgrading schemes tended to pollute the surrounding area, seep into groundwater and discharge into other rivers, lakes and bays. Thus, households that used waterborne sanitation ended up flushing their waste into the neighbourhood. The squatter upgrading schemes initially

planned for Norwood and Rosemount in Montego Bay, which first lacked sanitation, are some such examples.

Ignoring sanitation has thus become unacceptable with the recognition of the environmental and health dangers posed by the solution adopted by these households through default, namely pit latrines. Yet, because of cost, no easy solutions typically exist.

Sewers are the most costly form of sanitation. The cost of the sewer system and individual connection pro-rated for one household ranges from US \$1,000-2,000 - the single largest component of squatter upgrading costs and roughly the equivalent of one year's household income for poor households. Although costly, sewers are, typically, the best solution for environmentally sensitive areas, that is, those with high densities, steep slopes and high or low soil permeability. In the hilly squatter settlements of Montego Bay, no easy alternatives to sewers exist. If properly constructed, septic tanks can cost as much as sewers, typically US\$ 1,000 to US\$ 2,000 on steep terrain with hard rock. Pit latrines cost little to build but carry high environmental and health costs even when properly constructed. Choosing a sanitation solution that balances cost with environmental capacity - based on soil permeability, terrain, and density - has become a crucial challenge for upgrading projects.

f. Solid Waste Collection

Garbage is supposed to be collected twice weekly on specific days in residential areas in Montego Bay. The actual frequency of collection varies from twice weekly in formal sector residential neighbourhoods to never in some of the largest informal sector communities. The main reasons include lack of road access to large areas of informal settlement, lack of cooperation by residents, density and inadequate finance.

Forty-nine per cent of the households of the sampled informal sector communities lack direct access to roads. Consequently, garbage trucks cannot reach much of these areas. Communities without direct road access are supposed to deposit their garbage at specified points before the specified collections days so that the agency in charge of garbage collection can pick it up. Some communities do, while others do not. Thus, the level of community organization and cooperation plays a large role in the effectiveness of garbage collection. Some communities are considered criminal enclaves and garbage trucks and other service personnel refuse to enter them.

The sheer amount of garbage produced in the densest informal sector communities - such as tenement yards - often overwhelms the capacity of the garbage trucks employed by the firms contracted to collect garbage. Western Parks and Markets, the regional agency in charge of garbage collection, has sub-contracted collection work in Montego Bay to 14 private companies. These sub-contractors use ordinary tippers or dump trucks, which results in frequent spillage from the uncovered tops onto streets and roads, rather than compactor trucks, which are covered and can condense garbage, allowing greater amounts to be collected per run.

The finance system established by central government is highly haphazard and inadequate. Western Parks and Markets collects no garbage fees and relies on funding from a central ministry which totals about US\$ 2.00 per year per person served. This funding is disbursed based on a zone system created in 1986 and which has not been updated. As a result, communities that have emerged since 1986 - mostly informal sector ones - lack an allocation and, therefore, receive no garbage collection.

The result is chaotic. Some contractors succeed in collecting on the designated days whilst others fall far behind schedule and collect haphazardly. The lack of compactor trucks slows down garbage collection in areas such as tenement yards which produce large quantities of garbage, throwing the waste-collecting agency and residents off schedule. Large, new informal sector communities such as Norwood and Rosemount have none of their garbage collected because they have been settled since 1986 and are thus excluded from the zone finance system.

Overall, the amount of garbage collected is much lower in informal sector communities than in formal sector ones (see Table 1). An average 61 per cent is collected in the sample informal communities compared to 72 per cent in mixed communities and 91 per cent in formal sector communities.

The negative environmental impacts of chaotic solid waste management are second only to sanitation in severity. Even when it is eventually collected, garbage causes health problems. One study of Montego Bay notes "...storage of waste prior to collection in open containers is easy prey for the elements and scavengers. Flies are prolific in the area of the containers... There is general dissatisfaction with the current collection methods..."⁽³⁶⁾ On the way to the dump, the open tipper trucks piled high with garbage cruise throughout Montego Bay and damage its tourist appeal.

Dump sites, both informal and formal, cause other problems. The formal dump site of Montego Bay at Retirement suffers from various environmental problems. Western Parks and Markets makes no attempt to move any earth in order to try to bury the refuse which constantly burns except during periods of prolonged rain. Flies infest the area, nitrates leach into groundwater and smoke from the burning casts a pall over much of the surrounding area of Granville, Pitfour, Gordons Crossing, Montego Freeport and the Sea Wind resort area depending on wind direction. During and after heavy rains, garbage trucks have difficulty navigating the roads to this dump and end up discharging their load along the roadside.

As noted, however, much garbage also remains uncollected. This, typically, gets dumped within informal settlements or burned. If dumped, it blocks culverts, thus contributing to erosion, or washes into gullies and into the sea thus raising nitrate levels and causing algae blooms. Heavy rains wash down large quantities of garbage which sometimes floats by cruise ships and hotel beaches. Similar problems exist throughout Jamaica. Ominously, 13 of the 26 officially recognized dump sites in the country are located near bodies of water.

36. N.O. Whyte and Associates (undated), *Report on Social Infrastructure and Capital Facilities Component for the Greater Montego Bay Development Plan*, Montego Bay, Jamaica, 183 pages.

V. DEALING WITH THE PUBLIC COSTS AND ENVIRONMENTAL IMPACTS OF INFORMAL SETTLEMENT

INFORMAL SETTLEMENT THUS generates public costs of many kinds, many of them a result of negative environmental impacts. This section examines public costs from a policy perspective and discusses what can be done to improve the situation particularly through settlement policy. In particular, it compares the cost of providing urban services to informal sector development with that of formal sector development. We examine squatter upgrading projects as the informal solution and government serviced site projects and private sector moderate-income projects as the formal solutions.

This comparison has programme and policy implications. The appeal of squatter upgrading comes largely from its alleged lower cost. If the cost of providing services to formal sector solutions is comparable to that of squatter upgrading, however, the attraction of upgrading drops and that of serviced sites and core units increases.

First, the development costs of three types of housing solutions are examined **without** taking into account the public costs necessary to protect community health and the environment and then **with** these measures. This data was developed from an analysis of a number of projects of each type and from interviews with leading public and private-sector development cost experts.

Table 2: Development Cost of Government Squatter Upgrading, Government Serviced Sites and Private Sector, Moderate Income Projects (in JA, 1992)

Characteristics of projects	Government random squatter upgrading project	Government serviced sites project	Private sector moderate income project
Density	Maximum 25 units/hectare (10 units/acre)	10-15 units/hectare (4-6 units/acre)	7.5-12.5 units/hectare (3-5 units/acre)
Roads and footpaths or sidewalks	12,000 - 17,000	30,000-40,000	35,000-45,000
Water	9,000-12,000	9,000-12,000	9,000-12,000
Drainage	7,000-10,000	5,000-8,000	6,000-9,000
Sanitation	0	20,000-35,000	30,000-40,000
Electricity	0	0	2,600
Relocation, reimbursing crops & security	1,714-5,141	0	0
Profit	0	0	12,380-32,580
Total development cost	29,714-44,141	64,000-95,000	94,990-141,180, including profit 82,600-108,600, excluding profit

SOURCES: Interviews with cost surveyors and analysis of two projects of each type. In 1992; US\$ 1.00 = JA 20

37. This example, therefore, does not cover cases (such as parts of Norwood and Rosemount) where government has pegged an area for a housing scheme and squatters locate their houses within the pegs when they capture land.

38. Adding land costs to this picture would not dramatically change the findings because land represents only a modest share of total development cost in Jamaica.

Table 2 presents the development cost per household of a government sponsored squatter upgrading project **without** taking into account the public costs necessary to protect community health and the environment and then compares these costs with those of a government sponsored serviced sites project and those of a private sector project. "Random" squatter upgrading refers to the improvement of squatter communities that have been settled haphazardly without systematic layout or organization.⁽³⁷⁾

Not taking public costs into account, the total development cost per household in a squatter upgrading project is less than half that of a government sites and services project and a third that of a private sector project.⁽³⁸⁾ A key feature of the squatter upgrading scenario presented in Table 2 is that it does not include a sanitation solution. This assumption reflects practice to date. At the time of the research, no squatter upgrading schemes in Montego Bay had included sewers or a sanitation solution.

However, this picture changes dramatically after taking into account public costs unpaid by either the developer or households and which are borne by third parties or the public. Table 3 presents development costs per household taking into account these public and third-party costs.

The gap between squatter upgrading and the two formal sector solutions has closed greatly. Only about JA 10,000 (10 to 15 per cent of total serviced sites costs) separates the two. The upper range of squatter upgrading (JA 86,141) exceeds the lower range (JA 65,500) of serviced sites. If squatters' own investments in infrastructure prior to the upgrading scheme were considered (they are **not** in this table), the remaining gap would narrow further or disappear. These squatter investments would include the time and money squatters spend in connecting illegal water and electricity lines and in digging a leach pit.

The inclusion of environmental impacts is chiefly responsible for raising the total cost of squatter upgrading schemes to levels comparable to those of serviced sites. In many contexts, this comparison may be much more unfavourable to squatter upgrading projects than that presented in Table 3 because squatter upgrading projects are often located on inappropriate sites - far from existing infrastructure lines, on steep slopes, over aquifers, etc. These inappropriate sites translate into higher per unit costs for many services. In the case of location, substantial distance from existing infrastructure lines (trunk water, sewers, electricity lines and access roads) greatly raises the per unit cost.

Although costs are comparable, the quality of the infrastructure and services provided as part of squatter upgrading projects is inferior to that of serviced site projects in many respects. As discussed, road access and density play a fundamental role in this lower quality. In addition, cost recovery on squatter upgrading sums is, typically, negligible. In Jamaica, residents repay government developers nominal sums for this infrastructure investment. In contrast, purchasers of serviced sites, typically, must repay significant shares of the cost of their solutions.

In sum, squatter upgrading is problematic for government. It

Table 3: Development, Public and Third-party Costs of Squatter Upgrading, Sites and Services and Private Sector, Moderate Income Projects (in JA, 1992)

Characteristics of projects	Government random squatter upgrading project	Government sites and services project	Private sector moderate income project
Density	Maximum 25 units/hectare (10 units/acre)	10-15 units/hectare (4-6 units/acre)	7.5-12.5 units/hectare (3-5 units/acre)
Roads and footpaths or sidewalks	12,000-17,000	30,000-40,000	35,000-45,000
Water	9,000-12,000	9,000-12,000	9,000-12,000
Drainage	7,000-10,000	5,000-8,000	6,000-9,000
Sanitation	25,000-40,000*	20,000-35,000	30,000-40,000
Electricity	1,500-2,000*	1,500-2,000*	2,600
Relocation, reimbursing crops & security	1,714-5,141	0	0
Profit	0	0	12,390-32,580
Total cost	56,214-86,141	65,500-97,700	94,990-141,180, including profit 82,600-108,600, excluding profit

SOURCES: Interviews with cost surveyors and analysis of two projects of each type. In 1992; US\$ 1.00 = JA 20

* Indicates a cost unpaid by developer or buyer that falls on a third party or the public.

39. This is, however, only a one-time windfall. The invaders subsequently sell their *de facto* and, often, para-legal rights to this land to subsequent households.

40. The most important advantage enjoyed by the initial squatters who invade a parcel is that they select themselves for whatever benefits accrue from capturing land. Government low-income housing programmes use patronage, point systems and other means to select a few households among many to receive the substantial subsidy typically contained in the solutions.

results in lower quality infrastructure and services for, at best, the same cost as serviced sites if public and third party costs are taken into account.

However, informal settlement has a key advantage for the first households involved. The squatters who initially invade the land appear to capture it for free.⁽³⁹⁾ In comparison, purchasers of formal sector solutions, that is serviced sites and core housing, supposedly pay for the land as part of the sale price. Even the advantage of capturing land, however, diminishes on closer inspection. Although the invaders do not pay the owner for the land, they usually incur considerable costs in time, money, help from friends and relatives and, sometimes, risk to life and limb necessary to hold on to their parcel. Although government charges for serviced sites and core units, it often incorporates only a small part of the market value of the land into the sale price. On balance, even the "free" land that invaders capture may result in costs comparable to those paid for land by recipients of formal sector government solutions such as serviced sites and core units.⁽⁴⁰⁾

Who bears the public costs and environmental impacts of unguided squatter settlement? Government, typically, bears the bulk of the extra costs of rationalizing road networks, extending infrastructure to unguided squatter settlement and picking up garbage. But the level of government depends on the institutional context. In Jamaica, central government infrastructure supply agencies and parastatals (the National Water Com-

41. The Jamaica Power Service supposedly builds its capital costs into its rates. Nevertheless, illegal connection and, therefore, theft of electricity is extremely widespread in informally settled areas to which the Service has officially extended lines.

42. Many studies confirm this conclusion. See, for example Kingsley, Ferguson, Bower and Dice 1994 in note 8 for a review; see also Hardoy, Jorge E. and David Satterthwaite (1989), *Squatter Citizen: Life in the Urban Third World*, Earthscan Publications Ltd., London.

43. Study conducted by the Venezuelan Ministry of Urban Development.

mission for sewer and water lines and plants, Jamaica Power Services for electricity lines and stations) shoulder much of the capital cost of extending infrastructure to new informal sector settlement. Service tariffs, at best, cover on-going operation and maintenance but fail to cover capital costs with the partial exception of electricity.⁽⁴¹⁾ Western Parks and Markets - a parastatal supported by central government - heavily subsidizes garbage collection. In other countries, decentralization of service provision responsibilities has resulted in local government bearing much of the cost of infrastructure extension.

Poor residents of these communities bear much of the immediate negative environmental and health impacts.⁽⁴²⁾ Morbidity and mortality rates in poor communities from diseases closely linked to environmental quality, namely infant mortality, diarrhoea and respiratory diseases, are usually various multiples of those of moderate and upper-income communities. However, the city as a whole is also at risk. Public health authorities in Montego Bay note that only a miracle has saved the area from major epidemics.

As the scale of informal sector communities grows, the private sector also shoulders substantial costs. Upscale residential developers in Montego Bay pay a high premium for sites that are, or can be, physically isolated from poor communities, for example on peninsulas. The largest hotel chains have now left the urban area of Montego Bay and developed all-inclusive resorts at a safe distance from the city. The hotels that remain, many as private sector businesses, see their enterprises threatened in the medium term by the chaotic spread of low-income settlement and, with it, physical insecurity.

Evidence from other regions also suggests that informal settlement exacts tremendous costs at least comparable, and often greater than those necessary to provide basic formal sector solutions. A thorough study of the upgrading investment necessary for Caracas barrios, for example, results in a figure of US\$ 5,000 per unit, about the same amount as a government sponsored 40 square metre expandable unit.⁽⁴³⁾ This finding has crucial policy implications. Governments do economize **short-term** when they allow unguided informal settlement to take place. The upfront cash costs of upgrading are less than those of serviced sites. However, governments reap great public costs from the resulting informal settlements **mid and long-term**. Subsequent administrations end up extending infrastructure and urban services via upgrading projects that, nevertheless, result in lower environmental and health quality than if basic formal sector development were undertaken to begin with. Thus, a critical challenge for settlement policy is to avoid unguided land invasions by getting ahead of the demand curve for low-cost shelter solutions. Developing basic formal sector solutions at the onset is much less expensive than fixing the chaos caused by unguided squatter invasions.

Governments have great problems meeting this challenge. Despite much rhetoric to the contrary, many governments alternate between two ineffective approaches to shelter. The traditional mistake is to produce small numbers of relatively high-

44. The high per-unit subsidies in complete social housing units attract the middle-class particularly when systemic problems - such as rent control and lack of basic infrastructure - block market mechanisms. Typically, more prosperous groups find ways of seizing both complete units and the subsidies intended for low-income households.

45. Similar situations arise in the provision of credit to households. Either government provides mortgage finance directly to households - typically, these direct government mortgage loans show huge default rates because households know that government has little will or capacity to foreclose - or government contracts private sector financial institutions to lend to households but at very high fees.

46. Housing experts often cite the supposedly lower cost of squatter upgrading - which this paper rebuts. Housing NGOs, increasingly, are given a greater role in squatter upgrading efforts.

47. See reference 6.

cost, highly subsidized units that end up going to the middle-class.⁽⁴⁴⁾ This approach usually has the support of strong factions in emerging countries including the formal sector construction and development industry and the formal sector financial institutions. These groups make money on new development for middle-income groups. Construction companies make money building the units whilst financial institutions profit from the mortgages.

Government often ends up paying high fees to these private sector firms in order to buy their participation in such "social housing." For example, governments in Latin America and the Caribbean frequently use a "turnkey" approach to developing complete units that results in little risk and guaranteed profits for a few large construction companies. Government provides the land, designs the units, extends the financing, acquires development approval and markets the units - these being the riskiest parts of development. Then, government contracts private builders for the construction - a relatively straightforward process. Households have to accept government choice of location, often far from jobs, on cheap land on the urban fringe, and the type and quality of the unit, often poor, in order to gain access to the large subsidies typically involved.⁽⁴⁵⁾ The large private firms, often contracted by government for the construction of these projects, have faced little risk, have enjoyed guaranteed profits and, hence, have formed an uncompetitive monopoly. And as noted earlier, politicians also benefit from the new development of complete units but receive little kudos from being present at groundbreakings for serviced site projects.

Some governments have tried to correct the high cost and poor targeting of the traditional approach through upgrading squatter settlements. These upgrading efforts, typically, are one-time investments in infrastructure, for example through rationalizing and paving a road network, by providing water and sanitation systems, etc. and this after land invasions have *de facto* determined the location and pattern of land development. The lobby for upgrading is often weaker than that for new development. Some politicians promote it because votes can be won by allowing squatter invasions and by further providing infrastructure sporadically as the need for support arises, mainly at election time. Housing NGOs and housing experts also often advocate upgrading for a variety of reasons.⁽⁴⁶⁾ However, as the Montego Bay experience indicates, unguided squatter upgrading results in high per unit costs and low cost recovery for modest results. In addition, it provides no additional solutions that relieve the pressure for land invasions.

The approach that provides the best potential for getting ahead of the demand curve is to "formalize" informal land development, to "informalize" formal development and to involve the private sector in implementing housing and infrastructure projects.⁽⁴⁷⁾ Various means exist to this end. For example, instead of producing a few high-cost, highly subsidized units, some governments have opted for massive serviced site projects and progressive unit projects (a core housing solution containing a multi-use room, a bathroom and kitchen space). This strategy

48. The community based organization (CBO) allows variations in payment or an extension of the loan if the family runs into legitimate financial difficulties. In the state of Sucre, Venezuela, for example, the state government housing agency has helped establish a network of CBOs in over 50 squatter settlements. These CBOs lend money to households over one to five-year terms and achieve cost recovery of around 50 per cent of the amount lent. In contrast, the main national government housing programme, under National Housing Law, recovers only about 20 per cent.

49. In addition, a contract between households organized into a community group (CBO) and the NGO, for example, can specify payments (by households, monthly) for specific services (assistance in acquiring building materials, help in design and construction, regularizing land title). This "social payment"

provides a minimal solution and guides subsequent construction to produce a complete unit (termed "consolidation"), typically through NGOs linked to community based organizations (CBOs). The on-going support is a key to making this strategy work. Without such guidance, these projects frequently remain unconsolidated and become problems.

The institutional infrastructure provided by NGO-CBO networks is a key to effective consolidation of minimal formal sector solutions and, thus, to making this strategy work. In some states of Venezuela, for example, NGOs channel small sums of money to community based organizations to form micro-credit rotating funds. These community organizations lend small sums for short periods of time (one to five years) at flexible yet relatively high interest rates which achieve good real cost recovery.⁽⁴⁸⁾ Strong social pressures and incentives exist for borrowing households to repay these micro-loans because the repayments recirculate to finance the consolidation of their neighbours' housing.⁽⁴⁹⁾

In effect, these governments have successfully organized and guided squatter invasions and assisted residents in consolidating their units. Often, these governments contract with the private sector for many aspects of development. The state of Aragua in Venezuela - one of the countries with the highest rates of squatter settlement - is one example (see Box 3).⁽⁵⁰⁾

In addition to guiding informal settlement, an effective low-

Box 3: Large-scale Serviced Sites in the State of Aragua, Venezuela

As one of Venezuela's fastest growing regions, Aragua faced tremendous land invasion pressures. It formed a housing agency in 1991 with funds from the country's new Decentralization Law that were earmarked for housing. Previously, government had constructed a modest number of complete units of 50 square metres. The new housing agency director and the governor realized, however, that their budget required a choice. They could either build 1,000 of these complete units over a two to three-year period - a negligible number relative to need - or attempt to meet need by greatly reducing cost and building many more units. They chose to attempt to meet need and reduce the pressure for invasions.

The Aragua housing agency selected serviced sites as the means to this end. From 1991-93, the agency developed over 11,000 of these solutions, more than central government provided in the state (8,000) over the same time period. The state housing agency's staff of 80 contracts out the production of these serviced sites to private firms. These solutions are relatively low-cost. They sell for US\$ 882, compared to new expandable units that sell for US\$ 5,500. State government authorities candidly describe their approach to meeting demand with low-cost, large-scale serviced sites as "organized invasions".

This high production has greatly reduced land invasion pressures in Aragua. However, it has proved politically problematic because, for many years, these settlements continue to look like shantytowns. Aragua is now addressing this difficulty with a consolidation programme.

(*cuota social*) model has been used by a low-income housing programme sponsored by the Inter-American Development Bank in Uruguay.

50. Ferguson, Bruce (1994), *Housing Sector Diagnostic - Venezuela*, prepared for the Inter-American Development Bank, Abt Associates, Washington, DC, 74 pages.

51. Even in the US and Great Britain, however, the costs imposed by multiplying land-use and other development regulations have created growing controversy. For a book-length study of the US case, see Lowry, Ira S. and Bruce Ferguson (1992), *Development Regulations and Housing Affordability*, The Urban Land Institute, Washington, DC, 180 pages.

52. Ferguson, B.W. and M.L. Hoffman (1993), "Land markets and the effect of regulation on formal sector development in urban Indonesia", *Review of Urban and Regional Development Studies* Vol.5, No.1, pages 51-73.

mal sector development. The land-use planning process of many countries in the South developed from traditional British and US concepts which are useful in more affluent societies in which the pace of urban development is far slower.⁽⁵¹⁾ Typically, the consequence is great complexity and lengthy delays that burden land development, thereby restricting urban land supply and raising development costs. For example, a quantitative analysis of the burden imposed by land-use planning in Indonesia places the amount at one-third of total development cost.⁽⁵²⁾ Structure plans, one-stop land use processing and lower standards are measures that can reduce these costs and greatly increase the scale of formal sector development.

The political will and foresight to take these measures, however, are still rare although perhaps increasing. Typically, governments resort to more incremental solutions. In Montego Bay, for example, government intends to market a sanitation package to two of the newest and largest squatter settlements, Rosemount and Norwood. Initially, the upgrading scheme for these areas provided for water but lacked a sanitation solution. Once contaminated, the water brought in by the upgrading scheme would have polluted the surrounding area, seeped through fissures in the limestone base rock into groundwater and discharged into Montego Bay, contributing to algae blooms and coral reef destruction.

The sanitation solution planned for Norwood and Rosemount consists of a double-vault dry pit latrine. Essentially, it consists of two concrete chambers. When one is full, soil is put on top and left to compost and residents shift to using the other. By the time the other is full, the compost can be dumped and the first chamber re-used. One double-vault dry pit latrine can serve a household of six to eight people. Thus, this solution greatly reduces the problem of grey water from contamination of piped-in water. Households must purchase or construct these double-vault pit latrines under the terms of the contract to buy their upgraded lots. This sanitation solution is appropriate for the medium to high densities of these informal settlements and costs less than individual septic tanks.

Such incremental solutions, focusing on sanitation, play an important role. If government is to gain control of urban development and the urban environment, however, it must face the high costs, high subsidies and inappropriate land-use and building standards that result in low formal sector production and unguided land invasions.

