PRASC

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Development Planning and the Estimation of Population Size in Small Spatial Areas: Using Population Census Data in Trinidad and Tobago

Development Planning and the Estimation of Population Size in Small Spatial Areas

Using Population Census Data in Trinidad and Tobago

Delivered by: Dr. Godfrey St. Bernard

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What this presentation will cover

1. Rationale for Population Estimates
2. Development Planning as a National Imperative
3. Towards Meaningful National Planning Imperatives
4. Contextualizing Emergent Population Challenges
5. Modeling Population Dynamics
6. The Virtue of Empirical Modeling
7. Data Sources
8. Estimation Technique
9. Practical Example – Diego Martin West Communities
10. Findings – Diego Martin West Communities
11. Practical Example – Sangre Grande Communities
12. Findings – Sangre Grande Communities
13. Challenges and Lessons Learned

Key Learnings: Challenges encountered & Favourite Tips

Rationale for Population Estimates

- **National planning is predicated upon the provision of optimal service to communities and in accordance with the principles of social justice.**

- **Thus, provision has to be made for the assurance of equity and equality in the distribution of resources across a mix of spatial areal units. This is even more important as each of the spatial areal units is contextually different.**

- **Yet at the same time, there ought to be some consideration given to obtaining population projections first at the national level but perhaps more importantly, at a mix of small areal spatial levels.**

Development Planning as a National Imperative

- **National Development Planning – an enterprise that thrives on having ideas future population sizes and its composition at national levels.**

- **This is important in the context of short-to-medium term population projection horizons and targets at national levels, in my context, Trinidad and Tobago.**

- **Thus, national development planning should be people-centred first and foremost focusing on human population dynamics – fertility, mortality, international migration and their impact on population size.**

Towards Meaningful National Planning Imperatives

- **National planning for human populations is often devoid a human population sensibility. Often times, nobody considers the population stock and characteristics of populations to be served in national spaces and the myriad sub-national spaces.**

- **National planning exercises are often impulsive or informed by political agendas that are devoid of objective thrusts.**

- **Thus, there is need for more objective thrusts that can fuel arguments of progressive entities that constitute advocacy movements championing elements of progressive sustainable development.**

Contextualizing Emergent Population Challenges

- **In Trinidad and Tobago, the national population size is tending towards a historical maximum.**

- **While some spatial areal units will continue to grow in population size, others will experience declining population size in tandem with national trends; albeit with variable timing, and with some already having experience declining population sizes.**

- **The consequences of these events are only heeded when it has become way too late to salvage emergent threats**

Modeling Population Dynamics

- **Aging is a common phenomenon in Caribbean societies and perhaps an indicator of prospective trajectories with respect to population growth rates in different spatial contexts.**

- **Modeling this phenomenon is likely to inform growth scenarios in the context of sub-national population projections that estimate future population sizes in domains classified as having populations that are either younger or older.**

- **At the national level, the Cohort Component Method is a principal methodology for obtaining variable trajectories of national population sizes, annual population growth rates, age-sex population structures, and magnitudes of vital events for short to medium-term demographic trajectories into the future.**

The Virtue of Empirical Modeling

- **There is no universal remedy for accurately capturing the population size outcomes associated with social, economic, cultural, demographic and international dynamics.**

- **This is true even in the context of small areas such as communities and municipal areas.**

- **Therefore, mathematical models and statistical techniques do ably come to the rescue, rendering a helping hand to overcome absolute ignorance and permit sufficiently plausible estimates and projections of population size targeting small areal units within a national context.**

Data Sources

- **The data sources for the population projections of the selected communities were the respective Community Registers for the Trinidad and Tobago Population and Housing Censuses that were conducted in 1990, 2000 and 2011.**

- **The observed census population sizes were obtained for each of the selected communities as enumerated on the respective census dates: 15th May 1990; 8th June 2000 and 9th January 2011.**

Data Sources

- **The respective population sizes were disaggregated by sex and all population projections were generated for the sex-disaggregated populations.**

- **For both sets of communities (Sangre Grande and Diego Martin West), the enumerated population sizes provide a basis for assessing the reliability of population counts and estimating intercensal annual rates of population growth within sex-disaggregated populations in each of the selected communities.**

Estimation Technique

- **The base period used for the estimation of annual rates of population growth was the intercensal period 2000-2011.**

- **The extrapolation model was based upon exponential trending in accordance with the following model:**

  - $P_t = P_0 * e^{rt}$ **where:**

    - **t is the time that lapsed in years between the 2000 and 2011 census dates,**
    - **P_t is the enumerated population for the 2011 census date,**
    - **P_0 is the enumerated population for the 2000 census date and**
    - **100*r is the period annual growth rate (as a percentage) based on exponential trending.**

Estimation Technique

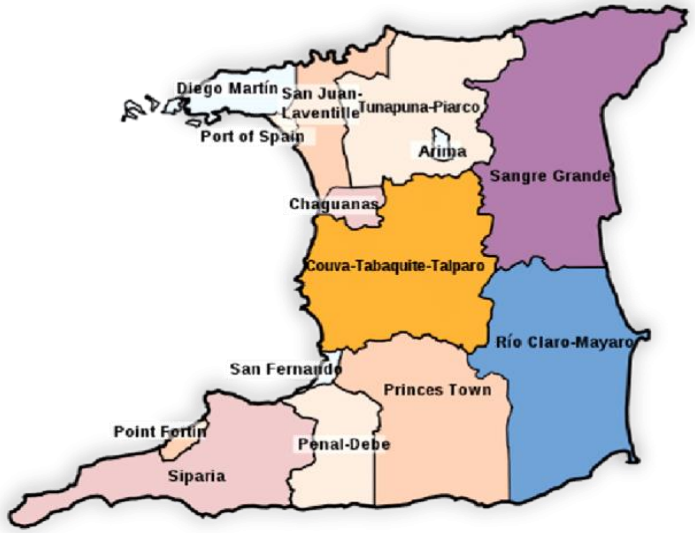
- **For each of the selected communities, r is estimated and used as a basis for making assumptions about the characteristics features of critical components of period population change.**

  - **$r = [\ln (P_t/P_0)]/t$ where:**
    - **t is the time that lapsed in years between the 2000 and 2011 census dates,**
    - **P_t is the enumerated population for the 2011 census date,**
    - **P_0 is the enumerated population for the 2000 census date and**
    - **100*r is the period annual growth rate (as a percentage) based on exponential trending**

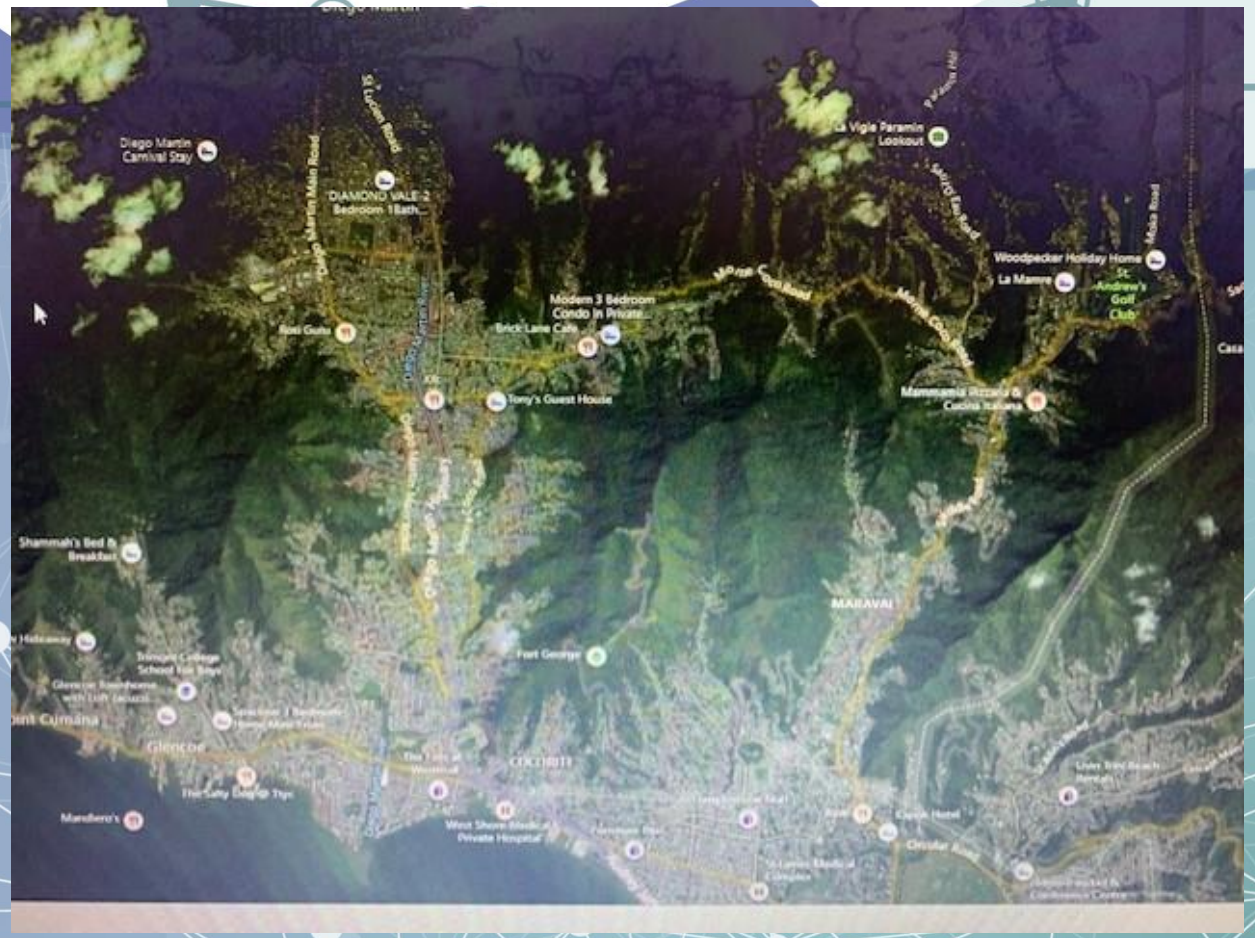
- **Note that r values are also used to make further assumptions about period population growth rates that are likely to characterize annual rates of population growth in subsequent quinquennial periods between 2011 and 2041.**

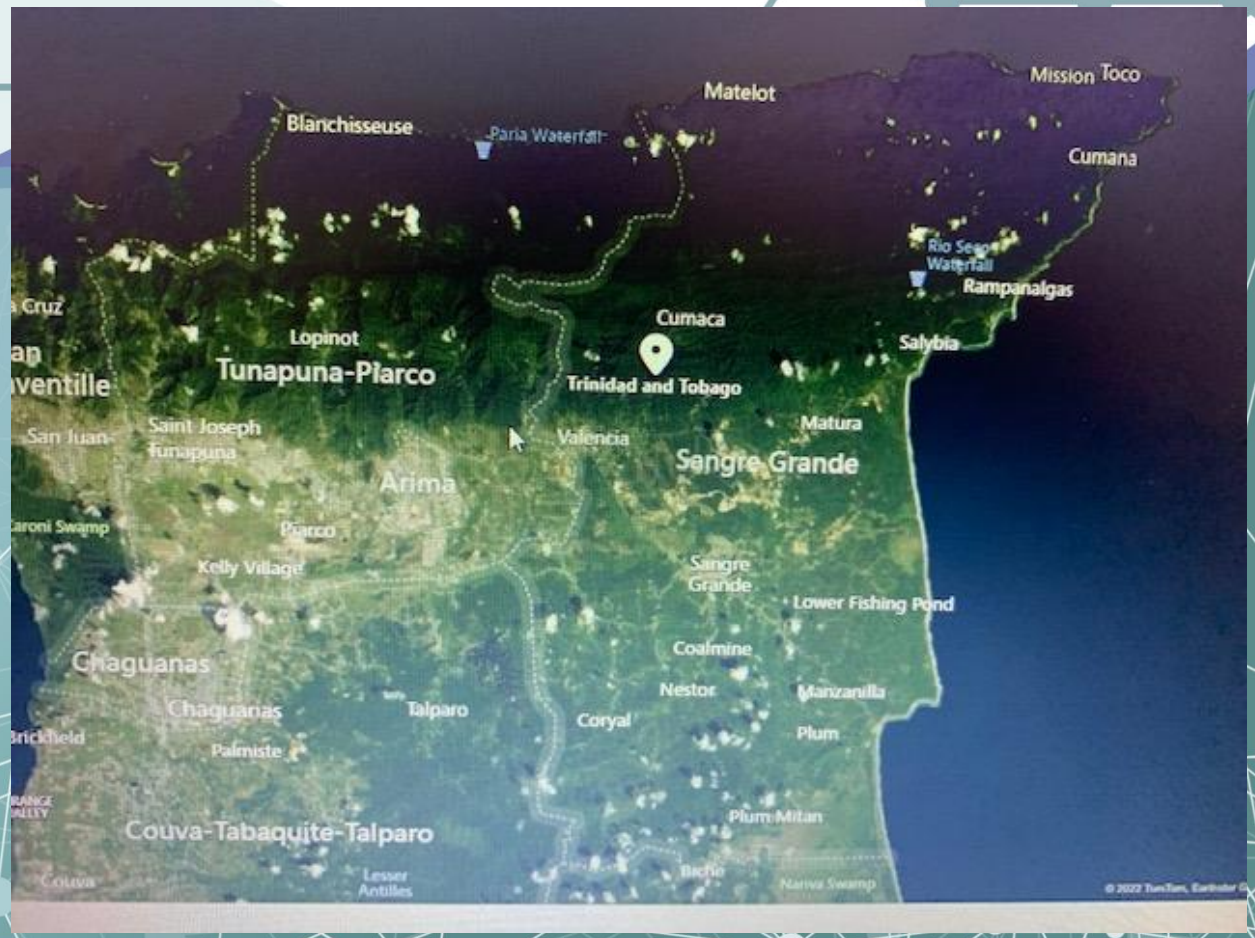
Cities, Boroughs, Regional Corporations and Tobago

Administrative Areas
City of Port of Spain
City of San Fernando
Borough of Arima
Borough of Chaguanas
Borough of Point Fortin
Diego Martin
San Juan-Laventille
Tunapuna-Piarco
Sangre Grande
Couva-Tabaquite-Talparo
Rio Claro-Mayaro
Princes Town
Penal Debe
Siparia
Tobago



Diego Martin West and Sangre Grande Communities Satellite Images





Male Population Estimates – Diego Martin #1

DIEGO MARTIN COMMUNITIES	15th May 1990	8th June 2000	9th January 2011	9th January 2016	9th January 2021	9th January 2026	9th January 2031	9th January 2036	9th January 2041
MALE POPULATION									
Carenage	2691	2851	2816	2800	2785	2771	2758	2745	2733
Chaguaramas	...	640	234	146	91	56	35	22	14
L'Anse Mitan	848	951	870	834	800	768	737	708	680
Big Yard	447	528	433	394	359	327	298	272	248
La Horquette	467	390	380	375	371	367	363	359	355
Point Cumana	987	874	887	889	882	875	868	862	856
La Puerta	1219	2010	1881	1823	1768	1715	1664	1614	1567
Westmoorings	1141	1900	1679	1584	1495	1411	1333	1259	1189
Powder Magazine	**...**	**552**	**651**	**700**	**746**	**782**	**804**	**807**	**785**
Simeon Road	348	1297	1322	1327	1319	1312	1305	1298	1291
Diego Martin Proper	4938	3123	2918	2827	2739	2654	2573	2495	2420
Rich Plain	1315	1357	1426	1453	1465	1455	1446	1437	1429
Diego Martin Industrial Est	427	660	537	487	442	402	365	331	301
Diamond Vale	3202	2709	2469	2364	2264	2168	2077	1991	1908
Covigne	...	2088	1962	1906	1851	1799	1749	1700	1653
Glencoe	...	372	335	319	304	289	276	263	250
Bayshore	279	318	229	196	168	144	123	106	91
ALL AREAS	**32558**	**38666**	**37828**	**37677**	**37562**	**37427**	**37210**	**36826**	**36249**

Male Population Estimates – Diego Martin #2

DIEGO MARTIN COMMUNITIES	15th May 1990	8th June 2000	9th January 2011	9th January 2016	9th January 2021	9th January 2026	9th January 2031	9th January 2036	9th January 2041
MALE POPULATION									
Victoria Gardens	…	573	542	528	515	502	489	477	465
Alyce Glen	253	369	373	373	369	366	362	359	356
Four Roads Diego Martin	1841	1269	1109	1041	977	918	862	810	761
Green Hill Village	407	959	895	866	839	813	787	763	740
Bagatelle (Diego Martin)	**1511**	**2384**	**2906**	**3175**	**3434**	**3660**	**3822**	**3894**	**3849**
Patna Village	284	326	261	235	212	191	172	155	140
River Estate	771	800	680	630	584	541	501	465	431
Blue Basin	**790**	**1219**	**1660**	**1911**	**2178**	**2446**	**2692**	**2889**	**3010**
North Post	**216**	**188**	**216**	**229**	**241**	**250**	**254**	**252**	**249**
St. Lucien Road	**710**	**993**	**1151**	**1228**	**1297**	**1350**	**1377**	**1369**	**1363**
Petit Valley	**5559**	**4519**	**4551**	**4567**	**4585**	**4604**	**4624**	**4645**	**4667**
Le Platte	764	834	828	825	823	821	819	817	816
Cameron Road	**…**	**436**	**535**	**586**	**636**	**680**	**713**	**728**	**722**
Blue Range	606	539	463	431	401	374	348	325	303
Goodwood Gardens	537	638	629	625	621	617	614	611	607
ALL AREAS	**32558**	**38666**	**37828**	**37677**	**37562**	**37427**	**37210**	**36826**	**36249**

Female Population Estimates – Diego Martin #1

DIEGO MARTIN COMMUNITIES	15th May 1990	8th June 2000	9th January 2011	9th January 2016	9th January 2021	9th January 2026	9th January 2031	9th January 2036	9th January 2041
FEMALE POPULATION									
Carenage	2304	2820	2808	2803	2799	2795	2792	2790	2789
Chaguaramas	...	263	27	9	3	1	0	0	0
L'Anse Mitan	**842**	**873**	**943**	**973**	**999**	**1021**	**1038**	**1050**	**1056**
Big Yard	463	590	496	457	421	388	358	330	305
La Horquette	666	397	345	323	302	283	265	249	233
Point Cumana	1057	933	936	938	940	942	944	947	950
La Puerta	1249	2177	2010	1936	1865	1798	1733	1671	1612
Westmoorings	1332	2051	1840	1748	1662	1580	1503	1429	1360
Powder Magazine	**...**	**639**	**772**	**840**	**909**	**979**	**1050**	**1119**	**1188**
Simeon Road	342	1287	1327	1340	1346	1345	1344	1344	1345
Diego Martin Proper	5185	3312	3050	2934	2824	2718	2617	2520	2427
Rich Plain	1291	1399	1448	1464	1474	1475	1470	1465	1460
Diego Martin Industrial Est	395	622	560	533	507	483	460	439	418
Diamond Vale	3388	3085	2919	2844	2772	2703	2636	2571	2509
Covigne	...	2093	2034	2007	1981	1956	1932	1908	1886
Glencoe	...	435	383	361	340	320	302	285	268
Bayshore	311	360	279	247	219	195	173	153	136
ALL AREAS	**33201**	**39926**	**39400**	**39427**	**39562**	**39793**	**40120**	**40544**	**41062**

Female Population Estimates – Diego Martin #2

DIEGO MARTIN COMMUNITIES	15th May 1990	8th June 2000	9th January 2011	9th January 2016	9th January 2021	9th January 2026	9th January 2031	9th January 2036	9th January 2041
FEMALE POPULATION									
Victoria Gardens	…	641	592	570	550	530	511	492	475
Alyce Glen	297	390	414	424	432	437	441	442	441
Four Roads Diego Martin	1828	1383	1184	1101	1023	951	885	823	766
Green Hill Village	402	980	864	814	768	724	683	644	608
Bagatelle (Diego Martin)	**1480**	**2261**	**2809**	**3097**	**3397**	**3707**	**4026**	**4351**	**4678**
Patna Village	253	306	240	214	191	170	152	136	121
River Estate	819	859	713	653	598	548	503	461	423
Blue Basin	**714**	**1247**	**1787**	**2107**	**2473**	**2887**	**3354**	**3878**	**4460**
North Post	**165**	**159**	**208**	**235**	**264**	**295**	**329**	**364**	**401**
St. Lucien Road	**701**	**997**	**1152**	**1227**	**1301**	**1372**	**1440**	**1503**	**1562**
Petit Valley	5736	4863	4854	4851	4849	4849	4849	4851	4854
Le Platte	778	866	845	835	826	817	809	800	792
Cameron Road	**…**	**393**	**493**	**546**	**602**	**660**	**720**	**781**	**844**
Blue Range	581	533	459	428	399	372	347	324	302
Goodwood Gardens	622	712	609	566	526	489	454	423	393
ALL AREAS	**33201**	**39926**	**39400**	**39427**	**39562**	**39793**	**40120**	**40544**	**41062**

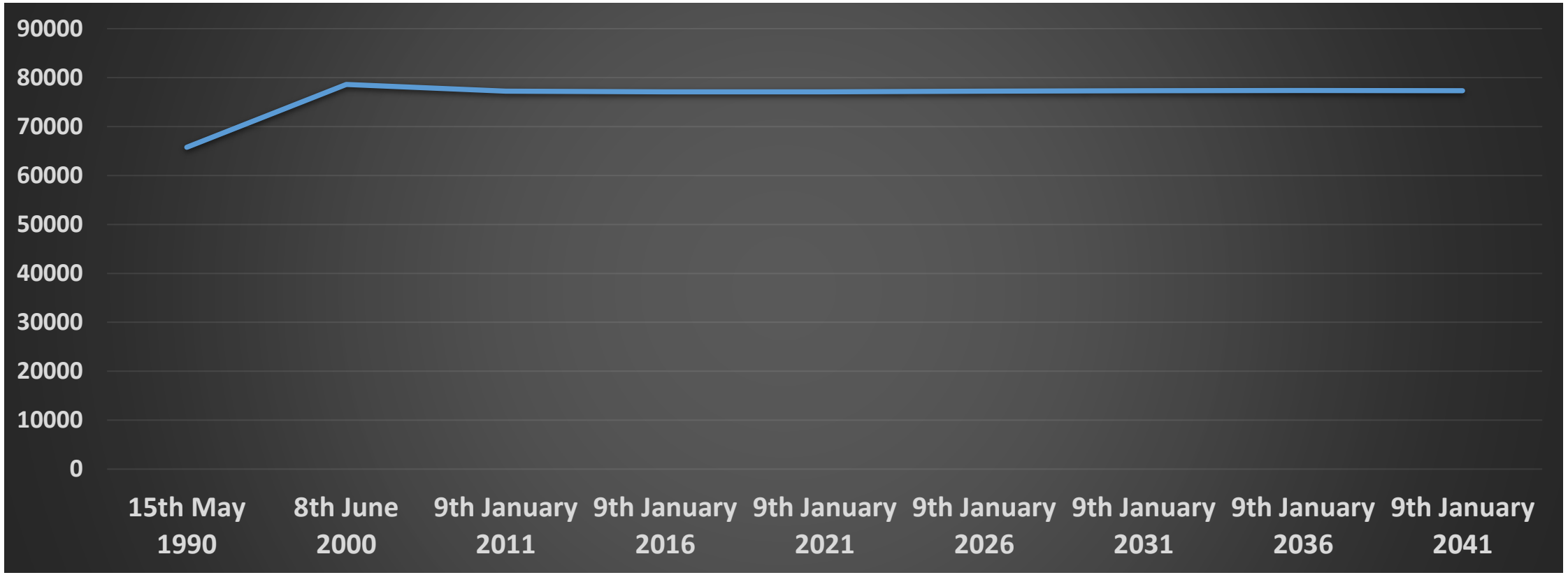
Both Sexes Population Estimates – Diego Martin #1

DIEGO MARTIN COMMUNITIES	15th May 1990	8th June 2000	9th January 2011	9th January 2016	9th January 2021	9th January 2026	9th January 2031	9th January 2036	9th January 2041
BOTH SEXES POPULATION									
Carenage	4995	5671	5624	5603	5584	5567	5550	5536	5522
Chaguaramas	...	903	261	155	94	57	35	22	14
L'Anse Mitan	1690	1824	1813	1807	1800	1789	1775	1757	1736
Big Yard	910	1118	929	851	781	716	657	603	553
La Horquette	1133	787	725	698	673	650	628	607	588
Point Cumana	2044	1807	1823	1826	1821	1816	1812	1809	1805
La Puerta	2468	4187	3891	3760	3634	3513	3397	3285	3178
Westmoorings	2473	3951	3519	3333	3157	2991	2835	2688	2549
Powder Magazine	**...**	**1191**	**1423**	**1540**	**1655**	**1762**	**1854**	**1926**	**1973**
Simeon Road	690	2584	2649	2667	2665	2657	2649	2642	2636
Diego Martin Proper	10123	6435	5968	5761	5562	5372	5190	5015	4847
Rich Plain	2606	2756	2874	2917	2938	2931	2916	2902	2889
Diego Martin Industrial Est	822	1282	1097	1020	950	885	825	770	719
Diamond Vale	6590	5794	5388	5208	5036	4871	4713	4562	4417
Covigne	...	4181	3996	3913	3833	3755	3681	3608	3539
Glencoe	...	807	718	680	644	609	577	547	519
Bayshore	590	678	508	444	388	339	296	259	227
ALL AREAS	**65759**	**78592**	**77228**	**77104**	**77124**	**77220**	**77329**	**77371**	**77311**

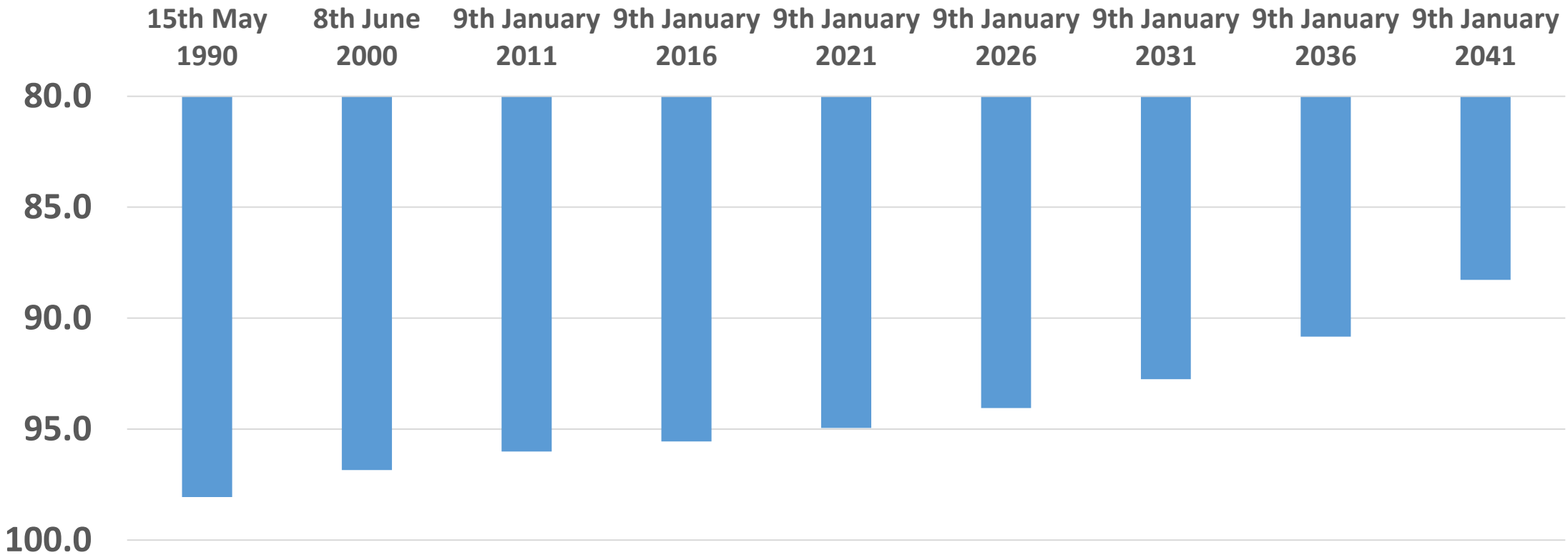
Both Sexes Population Estimates – Diego Martin #2

DIEGO MARTIN COMMUNITIES	15th May 1990	8th June 2000	9th January 2011	9th January 2016	9th January 2021	9th January 2026	9th January 2031	9th January 2036	9th January 2041
BOTH SEXES POPULATION									
Victoria Gardens	…	1214	1134	1098	1064	1031	1000	970	940
Alyce Glen	550	759	787	797	801	803	803	801	797
Four Roads Diego Martin	3669	2652	2293	2141	2000	1869	1747	1633	1527
Green Hill Village	809	1939	1759	1681	1607	1537	1470	1407	1348
Bagatelle (Diego Martin)	**2991**	**4645**	**5715**	**6272**	**6831**	**7367**	**7849**	**8244**	**8527**
Patna Village	537	632	501	449	403	361	324	291	261
River Estate	1590	1659	1393	1283	1182	1089	1004	926	854
Blue Basin	**1504**	**2466**	**3447**	**4019**	**4651**	**5333**	**6046**	**6767**	**7470**
North Post	**381**	**347**	**424**	**464**	**505**	**545**	**583**	**616**	**650**
St. Lucien Road	**1411**	**1990**	**2303**	**2455**	**2598**	**2722**	**2816**	**2873**	**2925**
Petit Valley	11295	9382	9405	9418	9434	9452	9473	9496	9521
Le Platte	1542	1700	1673	1661	1649	1638	1628	1617	1608
Cameron Road	**…**	**829**	**1028**	**1132**	**1238**	**1340**	**1432**	**1509**	**1566**
Blue Range	1187	1072	922	859	800	746	695	648	605
Goodwood Gardens	1159	1350	1238	1191	1147	1106	1068	1033	1001
ALL AREAS	**65759**	**78592**	**77228**	**77104**	**77124**	**77220**	**77329**	**77371**	**77311**

Population Sizes and Projections 1980-2041
Diego Martin West Communities



Sex Ratios and Projections 1980-2041 Diego Martin West Communities
Males per 100 Females



Key Findings – Diego Martin West Communities

- **Between 8th June 2000 and the 9th January 2011, the total population of all of the selected communities exhibited a decline which is projected to have continued into 2016.**

- **Interestingly, the overall population is projected to remain virtually unchanged between 2011 and 2041.**
    - **Sex ratios increasingly favouring females**
    - **Noteworthy population size increases are projected for north Diego Martin communities such as Blue Basin and Bagatelle**
    - **On the contrary, total population size declines are more likely to be evident in some of those communities characterized by greater levels of household affluence.**

Male Population Estimates – Sangre Grande

SANGRE GRANDE COMMUNITIES	15th May 1990	8th June 2000	9th January 2011	9th January 2016	9th January 2021	9th January 2026	9th January 2031	9th January 2036	9th January 2041
MALE POPULATION									
Valencia	2997	4193	6315	7624	9114	10732	12387	13944	15233
Town of Sangre Grande	7203	9116	10306	10866	11343	11665	11758	11559	11028
Melajo	139	264	433	544	677	830	998	1169	1330
North Oropouche	540	895	1147	1283	1421	1551	1658	1730	1751
Turure	651	886	1110	1229	1346	1453	1538	1587	1589
Matura	632	753	927	1018	1106	1184	1242	1271	1263
Salybia	130	129	131	131	130	129	128	127	127
Balandra	66	79	66	61	56	51	47	43	40
Rampanalgas	140	203	200	199	197	196	195	194	193
Mahoe	48	45	48	49	50	50	49	48	47
Tompire	72	85	63	55	48	41	36	31	27
Anglais Settlement	254	183	196	201	205	205	202	198	195
Cumana	649	618	587	573	560	547	534	522	510
Toco	614	585	609	618	620	613	607	600	594
Mission	219	153	159	161	162	160	158	156	154
L'Anse Noir	221	208	179	167	155	145	135	126	118
Sans Souci	320	309	264	245	228	212	197	183	170
Monte Video	72	85	83	82	81	80	80	79	78
Grande Riviere	187	184	212	226	238	246	251	249	247
Matelot	339	293	316	326	333	335	330	325	321
Guaico	1792	1517	1541	1545	1533	1522	1511	1501	1491
Cumuto	1679	1851	1916	1938	1940	1914	1888	1864	1840
Fishing Pond	1198	1408	1597	1686	1763	1816	1833	1805	1778
ALL AREAS	**20162**	**24042**	**28405**	**30826**	**33306**	**35677**	**37761**	**39312**	**40122**

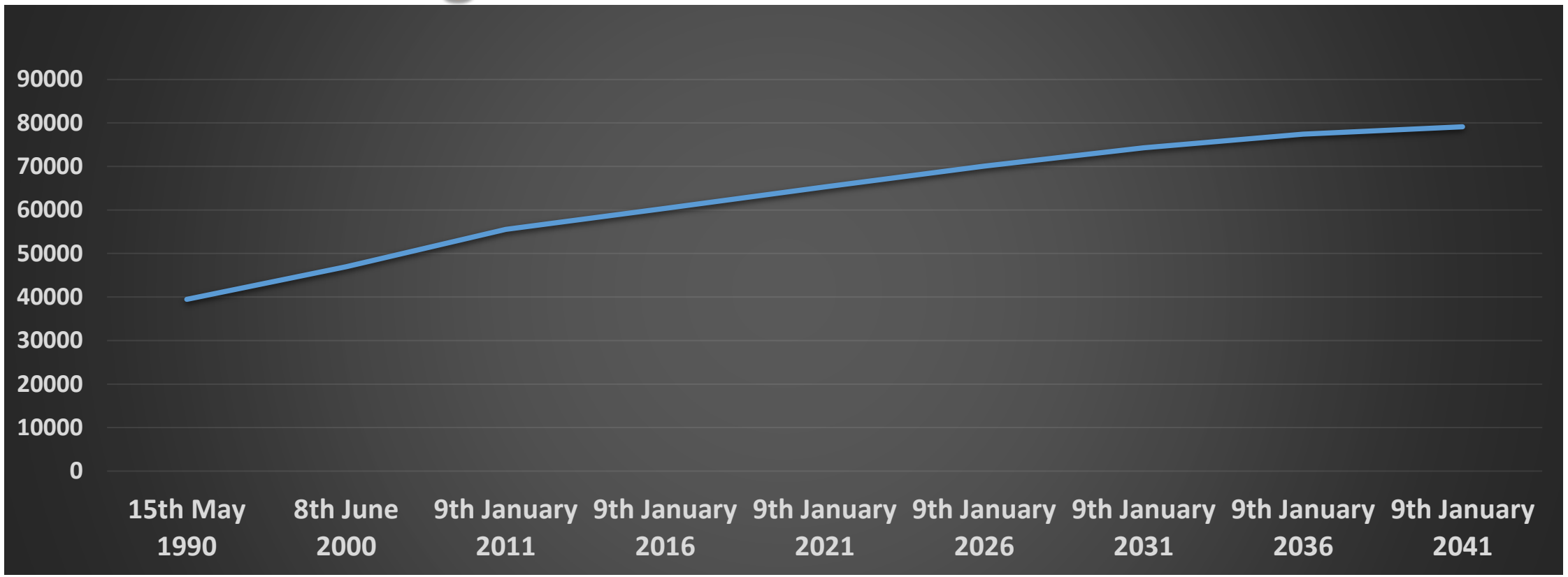
Female Population Estimates – Sangre Grande

SANGRE GRANDE COMMUNITIES	15th May 1990	8th June 2000	9th January 2011	9th January 2016	9th January 2021	9th January 2026	9th January 2031	9th January 2036	9th January 2041
FEMALE POPULATION									
Valencia	2922	3980	6019	7281	8720	10289	11898	13420	14690
Town of Sangre Grande	7191	9041	10404	11062	11645	12075	12274	12168	11706
Melajo	126	215	336	413	502	602	707	810	900
North Oropouche	446	825	1010	1106	1199	1280	1339	1367	1354
Turure	650	844	1124	1280	1444	1605	1747	1856	1913
Matura	625	692	846	926	1003	1070	1119	1141	1130
Salybia	99	95	115	125	135	143	149	152	149
Balandra	37	78	56	48	41	35	30	26	22
Rampanalgas	157	184	203	212	218	222	221	220	220
Mahoe	33	30	32	33	33	33	33	32	31
Tompire	67	63	52	48	43	40	36	33	30
Anglais Settlement	254	184	183	183	182	182	182	181	181
Cumana	558	528	530	528	527	525	524	523	522
Toco	552	548	573	582	586	581	576	571	566
Mission	162	135	130	128	126	123	121	119	117
L'Anse Noir	194	153	168	175	180	182	181	180	179
Sans Souci	263	226	212	206	200	194	188	183	178
Monte Video	85	68	65	64	62	61	60	59	57
Grande Riviere	153	150	180	195	210	222	230	232	228
Matelot	260	230	237	239	239	239	239	239	239
Guaico	1804	1526	1517	1513	1510	1507	1504	1502	1500
Cumuto	1590	1774	1708	1678	1649	1621	1594	1568	1542
Fishing Pond	1075	1336	1460	1515	1556	1575	1562	1550	1538
ALL AREAS	**19303**	**22905**	**27160**	**29538**	**32009**	**34405**	**36515**	**38132**	**38995**

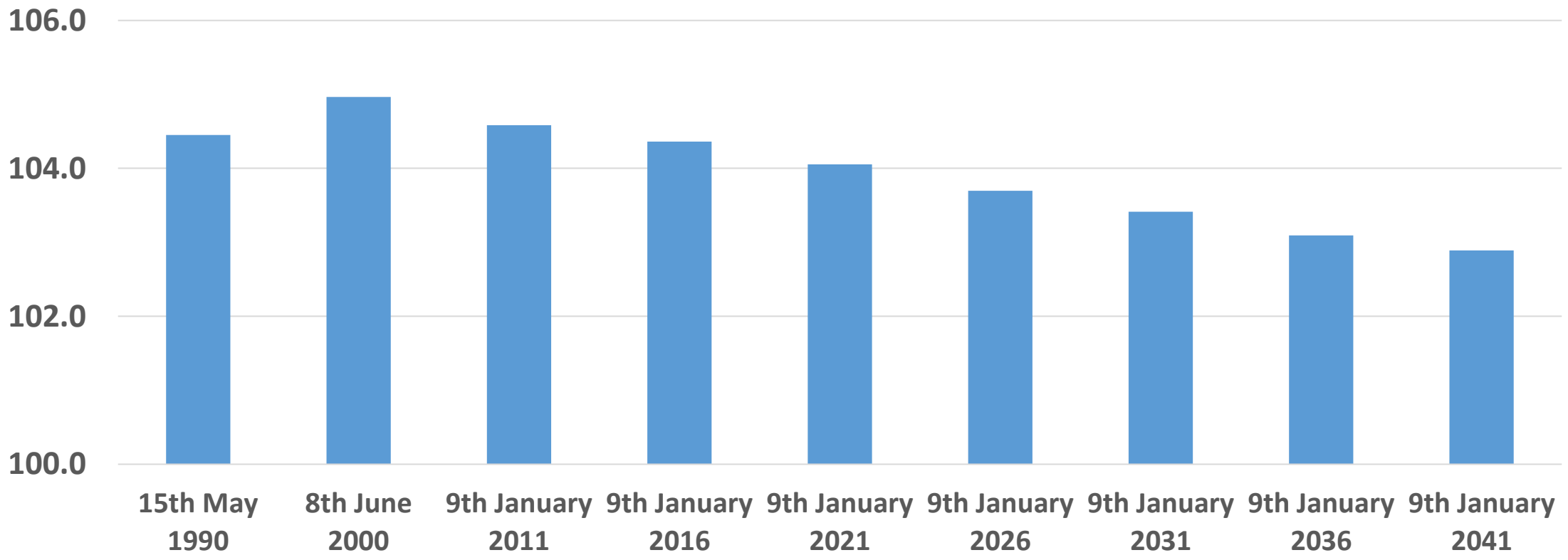
Both Sexes Population Estimates – Sangre Grande

SANGRE GRANDE COMMUNITIES	15th May 1990	8th June 2000	9th January 2011	9th January 2016	9th January 2021	9th January 2026	9th January 2031	9th January 2036	9th January 2041
BOTH SEXES POPULATION									
Valencia	5919	8173	12334	14906	17834	21020	24285	27364	29923
Town of Sangre Grande	14394	18157	20710	21928	22988	23740	24032	23727	22734
Melajo	265	479	769	957	1179	1432	1704	1979	2230
North Oropouche	986	1720	2157	2389	2620	2830	2998	3097	3105
Turure	1301	1730	2234	2509	2790	3058	3285	3443	3502
Matura	1257	1445	1773	1943	2108	2254	2361	2413	2393
Salybia	229	224	246	257	265	273	278	279	276
Balandra	103	157	122	109	97	86	77	69	62
Rampanalgas	297	387	403	410	416	418	416	414	412
Mahoe	81	75	80	82	83	83	82	80	79
Tompire	139	148	115	102	91	81	72	64	57
Anglais Settlement	508	367	379	384	387	387	383	380	376
Cumana	1207	1146	1117	1101	1086	1072	1058	1045	1032
Toco	1166	1133	1182	1200	1206	1194	1182	1171	1160
Mission	381	288	289	289	287	283	279	275	272
L'Anse Noir	415	361	347	341	335	327	317	306	297
Sans Souci	583	535	476	451	427	405	385	366	348
Monte Video	157	153	148	146	144	141	139	137	135
Grande Riviere	340	334	392	421	447	468	481	481	475
Matelot	599	523	553	565	572	573	569	564	560
Guaico	3596	3043	3058	3058	3043	3028	3015	3002	2991
Cumuto	3269	3625	3624	3616	3589	3535	3482	3431	3382
Fishing Pond	2273	2744	3057	3201	3319	3391	3396	3355	3316
ALL AREAS	104.450085	104.450085	104.450085	104.450085	104.450085	104.450085	104.450085	104.450085	104.450085

Population Sizes and Projections 1980-2041
Sangre Grande Communities



Sex Ratios and Projections 1980-2041 - Sangre Grande Communities
Males per 100 Females



Key Findings – Sangre Grande Communities

- **The total population of the selected communities is projected to increase consistently from 2011 through to 2041; this being also evident for male and female sub-populations.**
  - **The largest populations are in the Town of Sangre Grande and surrounding communities such as Valencia, North Oropouche, Turure, Matura and Fishing Pond.**
  - **All of these communities are likely to exhibit consistent population size growth between 2011 and 2041. Interestingly, Melajo is likely to experience phenomenal population growth over the period 2011-2041**
  - **. In most of the remaining communities, population change is projected to be marginal with some evidence of population size decline likely to become manifest with the passage of time.**

Challenges and Lessons Learned

- **Geocoding households to maximally classify spatial units**

- **Classification of age as follows:**
  - **0-4 years, 5-11years, Under 14 years, 15-24 years, 15-44 years, 15-49 years, 15-59 years, 15-64 years, 60+ years, 65+ years, 80+ years, 85+ years**

- **Greater access to anonymized micro-level data that permit spatial analysis in small spatial units**

- **Has implications for using multivariate statistical techniques for determining urban-rural spaces that are country-specific**

Thank You for Your Attention