# Online Appendix C1 – Classification of Countries

The 2019 Revision of WPP maintained much of the established geographic classification but renamed Major Areas to Regions and Subregions replaced the prior Region. Some level of ambiguity was introduced by adding the new group of Sustainable Development (SDG) regions for supporting the monitoring of progress against the Sustainable Development Goals (SDG). As the eight SDG regions are referred to also as regions, the reader may confuse the six geographic regions with the eight SDG regions. For this paper, we adopt the new naming convention and use only the geographic classification. Other groupings were occasionally prepared, but they are not discussed here.

| Category | Definition of groups |
|---|---|
| World | The world consists of all 235 countries (WPP2019). Demographic rates are weighted averages of the countries. |
| Region | Regions are the largest geographic groupings of countries and resemble continents. They are Africa, Asia, Europe, Latin America and the Caribbean, Norther America, and Oceania. Prior to the 2019 Revision Regions were referred to as Major Areas. |
| Subregion | Regions are the second-level geographic grouping, consisting currently of 21 groups. The number and composition of regions has seen some changes during the evolution of WPP. Prior to the 2019 Revision Subregions were referred to as Regions. |
| Country | The 235 countries in the 2019 Revision are nation states, dependent or outlying territories, and non-self-governing territories. The WPP list of countries is one of convenience and is designed to be exhaustive for the purpose of the World Population Prospects [a]. Listing of countries is politically sensitive and was subject to numerous changes over the course of WPP. |
| SDG regions | SDG Regions are those used in The Sustainable Development Goals Report [b]. |
| More developed regions | More developed regions comprise Europe, Northern America, Australia/New Zealand, and Japan. Countries in this group are designated as "developed countries" |
| Less developed regions | Less developed regions comprise all regions of Africa, Asia (except Japan), Latin America and the Caribbean plus Melanesia, Micronesia, and Polynesia. Countries in this group are designated as "developing countries" |
| Least developed countries | As of the 2019 Revision, the group of least developed countries includes 47 countries. The composition of the group is in flux and may change through admission into or graduation off countries by decision of the General Assembly. Further information is available at http://unohrlls.org/about-ldcs/. |
| Other less developed countries | Other less developed countries comprise the less developed regions excluding the least developed countries. |
| Landlocked Developing Countries (LLDCs) | 32 countries or territories<br>Further information is available at http://unohrlls.org/about-lldcs/ |
| Small Island Developing States (SIDS) | 58 countries or territories.<br>Further information is available at http://unohrlls.org/about-sids/ |
| Countries by income level | Classified according to GNI per capita from the World Bank |

[a] For a complete list, including small territories or areas not listed in WPP, see: https://unstats.un.org/unsd/methodology/m49/

[b] See: https://unstats.un.org/sdgs/indicators/regional-groups/

## Online Appendix C2 – Evolution of World Population Prospects

The results of the various Revisions of World Population Prospects (WPP) have generally been identified by their reference year and released and documented at the same or later years, dictated by the time-demanding in-house production of the various outputs.

The reference year is the year data collection, the preparation of estimates and the calculation of projections is completed. The preparation of each Revision's outputs in print, and later also on electronic media and the Population Division's web platform, has always been a challenging and time-consuming part of the projections. All this work is usually done by the Population Division itself, with little external support. For many Revisions, this meant that the publication date of the Revision is after the year the Revision refers to in its title.

In the following, the evolution of the Population Division's World Population Projections will be summarized by assuming the position of an outside user, e.g. by describing key elements of each Revision by the year the results were released and became available.

### The Nineteen Fifties

The decade of the 1950s posed many challenges for the demographers in the Population Division due to the paucity of demographic data, especially for developing countries. Significant efforts were required to collect data and perform the calculation – mainly by hand. Nonetheless, the demographers were quite correct to identify the pertinent population trends of the time: the world population was expected to more than double by the end of the century, the share of the population in developing countries would significantly increase, and population growth would vary significantly between regions, regions and countries.

The decade of the nineteen fifties saw three Revisions of the World Population Prospects, but not with titles now customary. The first issue (Revision), published in 1951, was more concerned with solid estimates of past population trends (1650 through 1950), than with population projections. It included, though, rough estimates of hypothetical population figures up to 1980 under three assumptions for vitals rates (low, medium, and high) for three of regions, distinguished by their position in the demographic transition[1]. A hypothetical projection assuming constant vital rates up to 1980 and for 11 regions was also presented. The world population in 1980 (medium variant) was projected at 3.3 billion, clearly too low.

The 1954 Revision was based on additional and updated past population estimates for all countries of the world within their actual boundaries for the years 1920, 1930, 1940, and 1950. The projections were produced for three variants (High, Medium, Low) that were themselves a combination of five types of demographic change (United Nations, 1954a, p. 298). The Revision's projected world population in 1980 came out at 3.6 billion, somewhat higher (11%) than in the previous Revision, but still comparatively low. The projections – rather extrapolations – were performed for the total populations of 25 regions. The 1954 Revision also produced figures for countries by splitting regions into its constituent countries by the ratio method (United Nations, 1954c; 1954a).

The 1957 revision again expanded the scope and refined the methodology used by projecting total population figures for countries up to 1975 and for major areas to 2000, using extensively so-called transitional population models (United Nations, 1958). The projected world population for the year 1980 increased again, this time to 4.2 billion[2]:

In only three revisions, the Population Division had to revise the projected world population in 1980 by about 1 billion people. This was prompted by improved empirical population data, especially China, and not so much by assuming higher growth rates. The 1957 revision introduced a first projection of the world's population in the year 2000, which, at about 6.3 billion people, was already remarkably close the today's estimate of 6.1 billion people for that year. In a case of lucky anticipation, the 1957 Revision, in a footnote, stated: "…there should be

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[1]Group I:     fertility and mortality have declined to low levels.
Group II:     mortality has declined substantially and fertility in lesser degree.
Group III:     fertility is high, having declined little, if at all, while mortality is high overall, although in some of the less populated
     countries it has fallen considerably in recent times.
[2] The 2019 Revision estimated the 1980 world population at 4.56 billion, about 9 per cent higher.

no cause for surprise with estimates of world population amounting to 6,000 or 7,000 million by the end of our century." (United Nations, 1958, p. viii).

During the 1950s a set of forty model life tables were developed by the staff of the Population Division especially as a tool for dealing with developing countries with deficient or lacking empirical evidence of mortality (United Nations, 1955). These initial model life tables were calculated for up to a last, open ended age group of 85 years and for levels of life expectancy ranging from about 19 to 72 years. They were first used in four signature studies for those developing parts of the world with reasonable demographic data in Central America, South America, South-East Asia, and Asia and the Far East (United Nations, 1954b; 1956a; 1959a; 1959b). These four studies covered the years 1950 to 1980. As this were exploratory projects, they are usually not counted as regular Revisions of WPP

## The Nineteen Sixties

In the nineteen sixties, the Population Division produced only just Revisions by reference year, but even published only one, the 1963 Revision, in 1966.

The 1963 Revision extended the coverage of countries and areas to 229 and introduced the category of more and less developed countries, a category that is still maintained, with few changes, today. It is noteworthy that the separation of countries into more and less developed countries was based on just a single criterion – the level of fertility around the year 1960. Based on a study (United Nations, 1965), it was suggested that a fertility level of about 2 daughters per woman[3] (or equivalently 4.1 children per woman as measured in Total Fertility Rate) may be used to distinguish countries by their level of development[4].

The 1960's limited yield in terms of released world population projections is not a reflection of less commitment and productivity of the UN's demographers. The Division was significantly involved in the second World Population Conference held in Belgrade in 1965 and in the upcoming first United Nations World Population Conference in Bucharest, Romania in 1974 (United Nations, 1974b), producing such authoritative reports as the updated and expanded Determinants and Consequences of Population Trends (United Nations, 1973a) and a number of background documents for the Conference, all based on the 1968 Revision (published in 1973).

The nineteen sixties also mark the time the Population Division began using increasingly electronic computers for its work. The use of computers, first mainframe machines, expanded greatly the capacity to perform demographic estimates and projections with ever greater detail. The addition of computers also had and continues to have a heavy toll in operating this tool and to develop, test and implement the custom-build software.

The 1963 Revision included estimates and projections for 196 countries, and formulated projection assumptions in terms of life expectancy (for both sexes combined) and sex-age adjusted birth rate, or "s.a.a.b.r.", a measure that now has lost its appeal. The technical maximum of life expectancy at birth was 73.9 years, which did not exclude certain countries from surpassing that limit. As for fertility, a continued decline of fertility was assumed, in combination with an assumed onset of decline where none was yet observed "…follows: the s.a.a.b.r. in successive five-year periods following onset of the decline is to average 97.5, 90, 80, 70, 60, and 52.5 per cent of its initial value and to settle thereafter at the level of 50 per cent" (United Nations, 1966, p. 46). The Revision used whenever possible and plausible national population projections, adjusted, or extrapolated if needed.

## The Nineteen Seventies

The nineteen seventies moved population issues from a more academic forum to the political agenda of the first United Nations World Population Conference, held in Bucharest, Romania in 1974. The decade of the seventies reaped momentous benefits of computerization of data processing for WPP.

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[3] The levels of fertility were expressed in the indicator of Gross Reproduction Rate (GRR) up to the 1984 Revision.
[4] Data from 123 countries or territories were selected with populations larger than 25,000 inhabitants. The metric used in the study was the Gross Reproduction Rate of 2.0, which corresponds to a total fertility / of about 4.1.

In 1973, the 1968 Revision was published (United Nations, 1973b), the first using computers. The introduction of computers enabled the Division to include sex and age as well as many useful demographic indicators for individual country projections. For the first time, interpolated population figures by single years of age were published. The Revision provide results 4 variants of different fertility pathways of developing countries, plus one variant for developed regions. In addition, past estimates of populations were produced from the base year of 1965 to 1950 for all countries (El-Badry & Kono, 1987, p. 38).

The 1968 Revision also implemented models of fertility and mortality transition. Evidence available at that time suggested an initial slow decline in developing countries after the onset of their transition to low fertility. "Hence, a general model for the speed of fertility decline was assumed here; that is, once the decline begins, fertility as measured by the gross reproduction rate would decrease by 5 per cent during the first five-year period, by 10 per cent during each of the next two five-year periods and by 15 per cent during each of the next three quinquennial periods, after which it would decline more slowly." (United Nations, 1973b, p. 5). This general model, with some adjustments, has been used successfully in subsequent Revision. One critical and persistent element utilizing the general model was the estimation of onset of the fertility decline.

The United Nations Model Life Tables (United Nations, 1956b) and the more recent Regional or Princeton Model Life Tables Model Life Tables (Coale & Demeny, 1966) were utilized for the projections, with specific considerations of regional and country specifics. This way it was possible to compensate for the wide-spread dearth of complete and reliable mortality data, especially in developing countries. This problem still exists today in principle.

The next two Revisions published during the 1970's updated the 1968 Revision with new data and moved the base year from 1965 to 1970 and 1975, respectively. The 1973 and 1978 Revisions were prepared for four variants – medium, high, low variants by matching assumed trends of fertility and mortality, plus a constant fertility variant (combined with the medium mortality variant). The projection horizon ended in the year 2000. Migration received short thrift in these projections, mainly because of poor evidence. In essence, net migration was assumed to diminish progressively, with few exceptions.

The 1973 Revision introduced revised assumptions regarding the highest male life expectancy of 72.6 years (the value given as maximum in the United Nations model life tables) and 77.5 years for females (the maximum in the Princeton model life tables), and revised the working model for mortality improvement (United Nations, 1977, p. 11). For fertility change, it introduced "Working Models of Fertility Decline", formulated in terms of the Gross Reproduction Rate (GRR).

Noteworthy was the 1978 Revision's conclusion: "As it appears now, the period of the most rapid growth of the world population has already passed and the world population is going to increase at a slowly declining rate." (United Nations, 1979, p. 3), an observation validated in subsequent Revisions. Irritatingly, this fact is still not fully acknowledged even today in many public debates; the notion of an ongoing population explosion is still very much current currency.

**The Nineteen Eighties**

The nineteen-eighties saw four Revision (the 1980, 1982, 1984 and 1988 Revisions), all with the projection horizon moved to 2025.

The projections variants used matched assumptions of fertility and mortality[5], combining high fertility and high mortality for the high variant, medium fertility and mortality for the medium variant, and low fertility and mortality assumption for the low variant. This attempt to consider the correlation between the demographic components during the demographic transition was temporary and not well documented. The 1982 Revision, for example, assumed only different trends in net migration for the four fertility variants (high, medium, low, and constant) but implemented only one mortality variant, designated medium. Model-based consideration of correlation between demographic components was implemented later with the introduction if statistical models that began with the 2010 Revision.

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[5] "As has been the tradition in the past, four variants of projections were prepared in the 1980 assessment: the medium, high, low, and constant variants. Selected results of the first three variants are provided in the statistical tables annexed to the present report. The distinctions among these three variants are largely due to the differences in assumed future fertility rates; however, varying assumptions are also adopted on future mortality and migration rates when such differentiations seem appropriate." (United Nations, 1981b, p. 1).

The 1980 Revision increased the maximum level of life expectancy at birth to 73.5 years for males and 80 years for females, based recent statistical records (United Nations, 1981b, p. 3). The 1982 and 1984 Revisions were updates of the 1980 Revision with few methodological changes.

The 1988 Revision was the first to user the Total Fertility Rate (TFR) as its fertility level indicator, replacing GRR. The three main projections variants combined medium, high, and low fertility and migration assumptions with a medium mortality variant. The constant fertility assumes constancy of the levels of fertility as of 1985 and medium mortality and migration assumption.

Owing to the extended projection horizon and the ongoing decline of mortality, the 1988 Revision revised the working model for mortality improvements[6] and expanded the life expectancy ceiling to a maximum 82.5 years for males and 87.5 for females. The working model was formulated as gains in life expectancy by level of life expectancy, separately for males and females and for Fast, Middle and Slow paths of improvement. (United Nations, 1989, p. 16). This model would be used until the 2002 Revision (see below.). The 1988 adopted a new model for the age – sex patterns of net migration that were constructed by combining age profiles of gross immigration and emigration, which are based on model schedules of gross migration (United Nations, 1989, pp. 65–70).

The 1988 Revision also included for the first time the special group of least developed countries (40 countries at the time of the 1988 Revision as determined by the General Assembly of the United Nations). The 1988 Revision revised the geographic classification by combining Tropical and Temperate South America to South America, deleting Regions (major areas) of East Asia and South Asia and placing them under Asia as subregions (areas), deleted the categories of Arab countries and non-Arab countries in Western Asia, and splitting the subregion (region) of Micronesia-Polynesia into separate subregions (regions) within Oceania (United Nations, 1989, p. 7).

Beginning with the 1982 Revision, the Population Division distributed results in digital formats on the media of the time as magnetic tapes.

## The Nineteen Nineties

In the nineteen-nineties the Population Division increased the frequency of world population projections to five per decade. Such an ambitious biennial production schema placed a heavy burden on the Division. A number changes had to be absorbed: the change in computing environment from mainframe computer to the personal computer and the introduction of relational databases as backbone for data storage and retrieval, plus the geopolitical changes after fall of the Iron Curtain (fifteen successor states to the Soviet Union, 5 successor states of Yugoslavia[7]), plus the unprecedented challenge posed by the emerging HIV/AIDS pandemic of HIV/AIDS. Already the 1992 Revision ventured to include the impact of HIV/AIDS in its estimates and projections, four years before UNAIDS was established.

The 1990 Revision introduced a small but important correction in how life expectancy would be aggregated. It replaced the former approximate calculation of aggregate life expectancies with a correctly weighted age-specific calculations. For example, the world life expectancy for 1980-1985 is 61.8 years in the 1990 revision, as against 59.6 years in the 1988 revision. New replacement-level age-specific fertility patterns were also introduced. This revision also offered the results on IBM and Apple Macintosh diskettes, in addition to magnetic tapes.

The 1992 Revision was the first Revisions reflecting the historical political changes after the fall of the iron curtain by Uniting Germany and splitting the USSR into the three Baltic states and the former USSR[8]; it also merged Democratic Yemen and (former) Yemen into the united Yemen. The 1992 Revision began the explicit modeling of the demographic impact of HIV/AIDS for 15 highly affected African countries by using a remarkably simple epidemiological model (EPI-model).

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[6] Replacing the model introduced in the 1973 Revision.
[7] The dissolution of former Yugoslavia was only completed in the 2006 Revision, as Serbia and Montenegro separated into independent states.
[8] The former USSR consisted of the 12 states that remained temporarily in the union. They were separately listed after the complete dissolution of the USSR in, as reflected in the 1994 Revision.

This model (Chin & Lwanga, 1991) employed a s-shaped Gamma function for short-term annual estimates of cumulative HIV infected adults, with adjustments made by the Population Division for the longer term WPP projection period.

The 1994 Revision extended its projection horizon to 2050, e.g. 60 years. The Revision continued to reflect the political changes of the time by breaking-up the former USSR into 12 successor states, Czechoslovakia into the Czech Republic and Slovakia, and Yugoslavia into 5 successor states (with more separations to follow). As for HIV/AIDS, it was assumed that after 2010 no new infections would occur.

The 1996 Revision expanded the number of countries for which HIV/AIDS was explicitly modeled to 28. The prospective impact of HIV/AIDS was extended by assuming that infections would stay constant at 50 per cent of the peak value of incidents.

The 1998 Revision implemented the final split of Yugoslavia by separating Serbia and Montenegro into independent states. The 1998 Revision extended the age format for all calculations up to 100 years. This required, inter alia, the extension of all five families of the Coale-Demeny model life tables and working model of mortality change to the ultimate age of 100 years. Past estimates (from 1950 to 1995) were also extended from 80+ to 100+. The 1998 Revision was the last to use the simple EPI Model for modeling the demographic impact of HIV/AIDS.

## The decade of 2000-2009

The Population Division continued its biennial production schema during the first decade of the 21$^{st}$ century and kept the projection horizon to 2050.

The 2000 Revision improved the handling of the HIV/AIDS epidemic by replacing the previously used Model by a procedure that reflected the demographic dynamics of the epidemic (United Nations, 2002, p. 10), including as a third time dimension the time from infection (in addition to calendar time and age). The model was an elaborate Excel workbook.

The 2002 Revision introduced a new and expanded HIV/AIDS projection model. The new model was based on the UNAIDS epidemiological model and its related software package called Epidemiological Program Package or EPP (Ghys *et al.*, 2004), but implemented and extended it in a full-fledged multistate model by age, sex and infection status and duration of incubation (for a comprehensive documentation see United Nations, 2006, p. 114).

The 2002 Revision also saw a substantive overhaul of its fertility projection models. The most striking, and controversial, change was the lowering of the ultimate fertility floor from 2.1 (which was also criticized) to 1.85 children for all countries. New model of fertility declines for high and medium fertility countries replaced the linear model used in previous Revisions (United Nations, 2004a, p. 183). The three models of mortality decline were extended to 92.5 years.

The 2004 Revision continued to improve projection methodology. It introduced a six-parameter double-logistic projection model for TFR decline (United Nations, 2004a, pp. 100–104) that was later the basis for the probabilistic projection model.
This Revision added two new models of gains in life expectancy, namely a very slow and a very fast model to the existing slow, medium, and fast models of mortality improvement. Still implemented as a lookup table, ending at 92.5 years of life expectancy at births.

The 2006 Revision added Montenegro and Serbia as two new independent states, completing the break-up of the former Yugoslav republic. The 2006 Revision transformed the existing models of mortality decline that were formatted as simple lookup tables into a six-parameter double-logistic format. This model, too, was later the basis for probabilistic mortality projections. The epidemiological model was improved with an expanded pediatric component.

The 2008 revision moved the base year of the Revision to 2010, two years ahead of its reference year. This Revision acknowledged (for the first time) the demographic effects of newly available treatment options for HIV/AIDS and corrected the prevalence levels for several countries downward.

## The Decade of 2010–2019

The five revisions published during the second decade of the 21st century extended the projection horizon to the 2100, revised the projection methodology substantively, and adjusted the treatment of the HIV/AIDS pandemic. The 2010 Revision (United Nations, 2011), by extending the projection horizon to 2100, had the longest projection period (90 Years) of the WPP history. This was not the only remarkable feat. It also marked the beginning of the transition to probabilistic projections, starting with fertility. A number of publications (Alkema *et al.*, 2011; Raftery *et al.*, 2012) documented the methodology in addition to the United Nations documentation (United Nations, 2014). The ultimate fertility level was moved (again) to 2.1 children per woman as a proxy for replacement levels of reproductivity. By moving the projection horizon to 2100, new and extended versions of the Coale-Demeny and United Nations model life tables were required. They were extended from 75 to 100 years of life expectancy at birth and validated against the Human Mortality Database.

The 2010 Revision kept the geographic classification of countries, but prepared estimates and projection for Taiwan as a separate entity and listed it as 'Other non-specified areas' under Eastern Asia. This practice would continue until the 2015 Revision.

The 2012 Revision (United Nations, 2013; 2014)introduced a new approach for projecting life expectancy at birth[9] that is based on a Bayesian hierarchical approach (an approach already employed for fertility earlier). The Population Division used a novel approach for modelling life expectancy at birth for males and females. Female life expectancy was modeled first by applying (in a probabilistic fashion) the established rate of mortality improvement by level of life expectancy at birth. Male life expectancy was derived by first modeling the gender gap between females and males, and then applying this measure to female life expectancy. By linking female and male life expectancy together, consistent, and plausible results are obtained. In a more general sense, male mortality could be seen as the combination of female mortality and maleness as an additional cause of death.

The 2012 Revision added new approaches for projecting age patterns of mortality. In addition to the updated and extended Model Life Table system (United Nations, 2015a), a modified Lee-Carter method (Li *et al.*, 2013) based on Human Mortality Database (Andreev *et al.*, 2013) was used.

The 2012 Revision noted slower expected fertility declines, even stalling, and in some countries increases in fertility in a substantial number of countries in sub-Saharan Africa (Bongaarts & Casterline, 2013; United Nations, 2013, p. 27). A small increase in the level of fertility was also seen in the more developed regions. Naturally, these upward adjustments in fertility levels may seem small now but could result in substantial increases in the size of those population in the long run.

The 2012 Revision was the basis for a bold statement, published in *Science*: "World population stabilization (is) unlikely this century". (Gerland *et al.*, 2014). If this will stand the test of time is not known, but it is probably a sign of a more active approach of the Population Division[10] in matters of open, and controversial, public discourse. Taiwan was now listed as its own entity, labelled as 'China, Taiwan Province of China'. Sudan was separated into Sudan and South Sudan.

The 2015 Revision (United Nations, 2015c; 2015b)continued to improve projection methodology incrementally (gender gaps in life expectancy, age patterns of fertility). Net migration was no longer assumed to vanish by the end of the projection horizon in 2100 but to converge to half the level it has been projected for 2045-2050.

Despite its shortcoming, the classification of countries by their development status as introduced in the 1963 Revision continues being used. The 2015 Revision added an alternative development metric to its country classification schema – the World Bank's groups of High, Medium and Low Income. This classification has the advantage of providing a more accurate grouping but has the disadvantage of being linked to a point in time. Historical comparisons are thus complicated, even impossible. It should be noted that the approach by income group places all countries for all times past, present, and future into the same category.

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[9] For countries not significantly affected by the HIV/AIDS epidemic.
[10] The Population Division was not the author of this article, but it permitted participation of its staff members.

The 2017 Revision (United Nations, 2017b; 2017a) added to the eight projection variants of the previous five Revision a momentum variant. The momentum variant combines instant replacement-level fertility, constant mortality, and zero net migration to illustrate the impact the age composition of populations has on future population trends (see table). The 2017 Revision explicitly included Taiwan under the name 'China, Taiwan Province of China' for the first time.

The 2017 Revision improved again the various models for projecting the demographic components. For instance, the model of gender gap in life expectancy was improved by use of historical data from before 1950.

The 2019 Revision (United Nations, 2019b) is an update to the previous revision, with relatively few changes to estimates and projection methodology. The base year of the 2019 revision was moved forward to 2020, one year ahead of its publishing date. The number of variants remains constant at nine; the impact of HIV/AIDS was explicitly modelled for 21 countries, and for 58 countries having ever experienced adult HIV prevalence of 1 per cent or more the impact of HIV/AIDS was factored in.

The 2019 Revision lists 235 countries by adding the French part of Saint-Martin and Saint-Barthélemy; Swaziland changed its official name to Eswatini. Also listed are 6 geographic regions and 21 geographic subregions[11]. The new Sustainable Development Goals (SDG) regions[12] comprise eight country aggregate that are (slightly) different to the hitherto used eight geographic regions. The 2019 Revision continued to implement improvements in methodology for the probabilistic projection models for fertility and mortality (United Nations, 2019c; 2019a). Net migration projections for the second half of the century were now kept constant at its level in 2045-2050.

**Projection variants Wpp2017, 2019**

| | Assumptions | | |
| Projection variant | Fertility | Mortality | International migration |
|---|---|---|---|
| Low fertility | Low | Normal | Normal |
| Medium fertility | Medium | Normal | Normal |
| High fertility | High | Normal | Normal |
| Constant-fertility | Constant [a] | Normal | Normal |
| Instant-replacement-fertility | Instant-replacement [b] | Normal | Normal |
| Momentum | Instant-replacement [b] | Constant [b] | Zero [b] |
| Constant-mortality | Medium | Constant [a] | Normal |
| No change | Constant [a] | Constant [a] | Normal |
| Zero-migration | Medium | Normal | Zero [b] |
| | | | |
| Probabilistic projections [c] | Prediction intervals (80 and 95 percent) | Prediction intervals (80 and 95 percent) | |

[a] as of the last estimation period (base period).
[b] as of the first projection period.
[c] In addition, associated prediction intervals for total population and selected broad age groups are given.
Source: https://population.un.org/wpp/DefinitionOfProjectionVariants

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[11] There are only 20 geographic subregions listed in WPP2019, missing the Australia/New Zealand subregion, which is listed as an SDG region. This accounts to 21 geographic subregions (as in the previous revisions).
[12] https://unstats.un.org/sdgs/indicators/regional-groups/

# World Population Prospects – A Long View
Thomas Buettner
*Annexes en ligne / Online Appendices*

## Summary of select parameters for the 1951-2019 Revisions

| Revision reference | Revision release | Time coverage [a] | Geographic coverage | Variants |
|---|---|---|---|---|
| 1951 | 1952 | 1650-1950-1980 | 5 Regions, 11 Subregions, 3 groups for projections | 3 variants (L, M, H) |
| 1954 | 1955 | 1650-1950-1980 | 199 Countries, 5 Regions, 25 Subregions | 3 variants (L, M, H) |
| 1957 | 1958 | 1950-1955-1975 [b] | 187 countries, 6 Regions, 19 Subregions | 3 variants (L, M, H) |
| 1963 | 1966 | 1920-1960-1980 [e] | 196 countries, 8 Regions, 24 Subregions | 3 variants (L, M, H) [c] Auxiliary variant (CF, ZeroMig) |
| 1968 | 1973 | 1950-1965-1985 [e] | 152 countries, 8 Regions, 24 Subregions | 4 variants (L, M, H, CF) [d] |
| 1973 | 1977 | 1950-1970-2000 | 155 Countries, 8 Regions, 24 Subregions | 4 variants (L, M, H, CF) |
| 1978 | 1979 | 1950-1975-2000 | 210 countries, 8 Regions, 24 Subregions | 4 variants (L, M, H, CF) |
| 1980 | 1981 | 1950-1975-2025 | 210 countries, 8 Regions, 24 Subregions | 4 variants (L, M, H, CF) |
| 1982 | 1985 | 1950-1980-2025 | 210 countries, 8 Regions, 24 Subregions | 4 variants (L, M, H, CF) |
| 1984 | 1986 | 1950-1980-2025 | 210 countries, 8 Regions, 24 Subregions | 4 variants (L, M, H, CF) |
| 1988 | 1989 | 1950-1985-2025 | 206 countries, 7 Regions, 22 Subregions | 4 variants (L, M, H, CF) |
| 1990 | 1991 | 1950-1985-2025 | 210 countries, 7 Regions, 22 Subregions | 4 variants (L, M, H, CF) |
| 1992 | 1993 | 1950-1990-2025 | 211 countries, 7 Regions, 22 Subregions | 4 variants (L, M, H, CF) |
| 1994 | 1995 | 1950-1990-2050 | 228 countries, 6 Regions, 20 Subregions | 4 variants (L, M, H, CF) |
| 1996 | 1998 | 1950-1995-2050 | 228 countries, 6 Regions, 20 Subregions | 4 variants (L, M, H, CF) |
| 1998 | 1999 | 1950-1995-2050 | 228 countries, 6 Regions, 21 Subregions | 4 variants (L, M, H, CF) |
| 2000 | 2001 | 1950-1995-2050 | 228 countries, 6 Regions, 21 Subregions | 7 variants (L, M, H, CF, CM, InstR, ZeroMig), NoAIDS variant for select countries |
| 2002 | 2003 | 1950-2000-2050 | 228 countries, 6 Regions, 21 Subregions | 7 variants (L, M, H, CF, CM, InstR, ZeroMig), NoAIDS variant for select countries |
| 2004 | 2006 | 1950-2005-2050 | 228 countries, 6 Regions, 21 Subregions | 7 variants (L, M, H, CF, CM, InstR, ZeroMig), NoAIDS variant for select countries |
| 2006 | 2007 | 1950-2005-2050 | 229 countries, 6 Regions, 21 Subregions | 8 variants (L, M, H, CF, CM, InstR, ZeroMig, NoChange; 3 AIDS scenarios (NoAIDS, HighAIDS, AIDSVaccine) for select countries |
| 2008 | 2009 | 1950-2005-2050 | 230 countries, 6 Regions, 21 Subregions | 8 variants (L, M, H, CF, CM, InstR, ZeroMig, NoChange); NoAIDS for select countries |
| 2010 | 2011 | 1950-2005-2100 | 230 countries, 6 Regions, 21 Subregions | 8 variants (L, M, H, CF, CM, InstR, ZeroMig, NoChange); NoAIDS for select countries |
| 2012 [e] | 2013 | 1950-2010-2100 | 232+1 countries, 6 Regions, 21 Subregions | 8 variants (L, M, H, CF, CM, InstR, ZeroMig, NoChange). |
| 2015 [e] | 2015 | 1950-2015-2100 | 232+1 countries, 6 Regions, 21 Subregions | 8 variants (L, M, H, CF, CM, InstR, ZeroMig, NoChange) |
| 2017 [e] | 2017 | 1950-2015-2100 | 233 countries, 6 Regions, 21 Subregions | 9 variants (L, M, H, CF, CM, InstR, ZeroMig, NoChange, Momentum) |
| 2019 [e] | 2019 | 1950-2020-2100 | 235 countries, 6 Regions, 21 Subregions | 9 variants (L, M, H, CF, CM, InstR, ZeroMig, NoChange, Momentum) |

[a] Calendar years are in sequence Estimation base year - projection base year- projection horizon. [b] Projection horizon for regions and subregions up to 2000. [c] Three variants for aggregates, medium variant for countries. [d] Four variants for developing countries, developed countries medium variant only. [e] AIDS scenarios no longer included

Notes: L for Low fertility variant; M for Medium fertility variant; H for High fertility variant; CF for Constant fertility variant; CM for Constant mortality variant; InstR for Instant replacement variant; ZeroMig for Zero migration variant; NoChange for No change variant (Constant fertility and mortality); Momentum for Momentum variant (Instant replacement fertility, constant mortality and zero migration); NoAIDS for Hypothetical variant assuming HIV/AIDS never existed

## Long-range projections of the United Nations

The United Nations has, on irregular occasions, prepared log-range population projections beyond the time horizon of an actual Revision. So far, there have been seven such long-range projections, each being consistent with the of the population projections of the *World Population Prospects* of 1968, 1978, 1980, 1990, 1996, 1998, and 2002, respectively (United Nations, 1974a, 1981a, 1982, 1992, 1998, 2000, 2004b). For all but the last long-range projection, results were presented for the world and its regions only. The long-range projection extending the 2002 Revision was prepared for all countries and their aggregates and, exceptionally, to the year 2300.

| Publication | *Associated Revision* | *Projection Horizon* |
|---|---|---|
| United Nations (1974). *Concise Report on the World Population Situation in 1970-1975 and its Long-Range Implications. Population Studies, No. 56* (No. 56). New York: Department of Economic and Social Affairs, Population Division. | *1968* | *2075 (?)* |
| United Nations (1981). Long-range Global Population Projections-Based on Data as Assessed in 1978. *Working Paper ESA/P/WP.75*. | *1978* | *2100* |
| United Nations (1982). Long-range global population projections, as assessed in 1980. *Population Bulletin of the United Nations, 14*. | *1980* | *2100* |
| United Nations (1992). *Long-range World Population Projections. Two Centuries of Population Growth 1950-2150*. New York: Department of Economic and Social Affairs, Population Division. | *1990* | *2150* |
| United Nations (1998). *World Population Projections to 2150*. New York: Department of Economic and Social Affairs, Population Division. | *1996* | *2150* |
| United Nations (2000). *Long-range World Population Projections: Based on the 1998 revision*. New York: Department of Economic and Social Affairs, Population Division. | *1998* | *2150* |
| United Nations (2004). *World Population to 2300*. New York: Department of Economic and Social Affairs, Population Division. | *2002* | *2300* |

## Directors of the Population Division

| Name | Citizenship | Sex | Starting date | Ending date |
|---|---|---|---|---|
| Frank Notestein [a] | USA | M | 9-Apr-1947 | 8-Oct-1948 |
| Pascal Kidder Whelpton | USA | M | 12-Nov-1950 | 30-Jun-1952 |
| John Durand | USA | M | 1-Jul-1953 | 1-Oct-1965 |
| Milos Maçura | Yugoslavia | M | 6-Mar-1966 | 15-Jan-1972 |
| Léon Tabah [b] | France | M | 16-Nov-1972 | 29-Feb-1984 |
| Jean-Claude Chasteland | France | M | 1-Oct-1984 | 30-Mar-1990 |
| Shunichi Inoue | Japan | M | 1-Apr-1990 | 30-Jan-1993 |
| Joseph Chamie [c] | USA | M | 1-Jan-1994 | 31-Dec-2004 |
| Hania Zlotnik | Mexico | F | 1-Feb-2005 | 31-Jan-2012 |
| John Wilmoth | USA | M | 2-Jan-2013 | |

[a] Frank Notestein's title was Director-Consultant.
[b] P. Shankar Menon was Officer-in Charge between Mr. Tabah's and Mr. Chateland's tenure.
[c] Larry Heligman was Officer-in Charge between Mr. Chamie's and Ms. Zlotnik's tenure.

## References of the Online appendices

**Alkema, L., Raftery, A., Gerland, P., Clark, S. J., Pelletier, F., Buettner, T. & Heilig, G. K. (2011).** Probabilistic Projections of the Total Fertility Rate for All Countries. *Demography*, *48*(3), 815–839. https://doi.org/10.1007/s13524-011-0040-5

**Andreev, K., Gu, D. & Gerland, P. (2013).** Patterns of Mortality Improvement by Level of Life Expectancy at Birth. *In: Paper presented at the Annual Meeting of the Population Association of America, New Orleans, LA*.

**Bongaarts, J. & Casterline, J. (2013).** Fertility Transition: Is sub-Saharan Africa Different? *Population and Development Review*, *38*, 153–168. https://doi.org/10.1111/j.1728-4457.2013.00557.x

**Chin, J. & Lwanga, S. K. (1991).** Estimation and projection of adult AIDS cases: a simple epidemiological model. *Bull World Health Organ*, *69*(4), 399–406.

**Coale, A. & Demeny, P. (1966).** Regional model life tables and stable populations. *In: Regional model life tables and stable populations* (p. 871). Princeton, NJ: Princeton University Press.

**El-Badry, M. A. & Kono, S. (1987).** Demographic Estimates and Projections. *Population Bulletin of the United Nations: Special Issue Nos. 46/47-1986*, *19/20*, 35–46.

**Gerland, P., Raftery, A., Sevcikova, H., Li, N., Gu, D., Spoorenberg, T., …& Wilmoth, J. R. (2014).** World population stabilization unlikely this century. *Science*. https://doi.org/10.1126/science.1257469

**Ghys, P. D., Brown, T., Grassly, N. C., Garnett, G., Stanecki, K. A., Stover, J. & Walker, N. (2004).** The UNAIDS Estimation and Projection Package: a software package to estimate and project national HIV epidemics. *Sexually Transmitted Infections*, *80 Suppl 1*, i5-9. https://doi.org/10.1136/sti.2004.010199

**Li, N., Lee, R. & Gerland, P. (2013).** Extending the Lee-Carter Method to Model the Rotation of Age Patterns of Mortality Decline for Long-Term Projections. *Demography*, *50*(6), 2037–2051. https://doi.org/10.1007/s13524-013-0232-2

**Raftery, A., Li, N., Sevcikova, H., Gerland, P. & Heilig, G. K. (2012).** Bayesian probabilistic population projections for all countries. *Proceedings of the National Academy of Sciences*, *109*(35), 13915–13921. https://doi.org/10.1073/pnas.1211452109

**United Nations (1954a).** Framework for Future Population Estimates, 1950-1980, by World Regions. In *Proceedings of the World Population Conference, 1954. Rome, 31 August - 10 September 1954, Papers: Volume III* (pp. 283–328). New York: United Nations.

**United Nations (1954b).** *Future Population Estimates by Sex and Age. Report I: The Population of Central America (including Mexico), 1950-1980*. New York.

**United Nations (1954c).** The Past and Future Population of the World and its Continents. In *Proceedings of the World Population Conference, 1954. Rome, 31 August - 10 September 1954, Papers: Volume III* (pp. 265–281). New York: United Nations.

**United Nations (1955).** Age and Sex Patterns of Mortality. Model Life-Tables for Under-Developed Countries. *Population Studies*, (22).

**United Nations (1956a).** *Future Population Estimates by Sex and Age. Report II: The Population of South America, 1950-1980*. New York.

**United Nations (1956b).** *Manual III: Methods for Population Projections by Sex and Age* (Manuals on Methods of Estimating Population). New York: Department of Economic and Social Affairs, Population Division.

**United Nations (1958).** *The Future Growth of World Population. Population Studies, No. 28*. New York: Department of Economic and Social Affairs, Population Division.

**United Nations (1959a).** *Future Population Estimates by Sex and Age. Report III: The Population of South-East Asia, 1950-1980*. New York.

**United Nations (1959b).** *Future Population Estimates by Sex and Age. Report IV: The Population of Asia and the Far East, 1950-1980*. New York.

**United Nations (1965).** *Population Bulletin of the United Nations, No. 7-1963, with special reference to conditions and trends of fertility in the world*. (United Nations Population Division, Ed.) (Vol. No. 6). New York.

**United Nations (1966).** *World Population Prospects as Assessed in 1963. Population Studies, No. 41*. New York: Department of Economic and Social Affairs, Population Division.

**United Nations (1973a).** *The determinants and consequences of population trends: new summary of findings on interaction of demographic, economic and social factors*. New York: Department of Economic and Social Affairs, Population Division.

**United Nations (1973b).** *World Population Prospects as Assessed in 1968. Populations Studies, No. 53*. New York: Department of Economic and Social Affairs, Population Division.

**United Nations (1974a).** *Concise Report on the World Population Situation in 1970-1975 and its Long-Range Implications. Population Studies, No. 56* (No. 56). New York: Department of Economic and Social Affairs, Population Division.

**United Nations (1974b).** *Report of the United Nations World Population Conference 1974*. New York.

**United Nations (1977).** World Population Prospects as Assessed in 1973. *Population Studies, No. 60*, viii, 183.

**United Nations (1979).** *World Population Trends and Prospects by Country, 1950-2000: Summary Report of the 1978 Assessment*. New York: Department of Economic and Social Affairs, Population Division.

**United Nations (1981a).** *Long-range Global Population Projections - Based on Data as Assessed in 1978. Working Paper ESA/P/WP.75*. New York: Department of Economic and Social Affairs, Population Division.

**United Nations (1981b).** *World Population Prospects as Assessed in 1980. Population Studies, No. 78*. New York: Department of Economic and Social Affairs, Population Division.

**United Nations (1982).** Long-range global population projections, as assessed in 1980. *Population Bulletin of the United Nations*, *14*.

**United Nations (1989).** *World Population Prospects 1988. Population Studies, No. 106*. New York: Department of Economic and Social Affairs, Population Division.

**United Nations (1992).** *Long-range World Population Projections. Two Centuries of Population Growth 1950-2150*. New York: Department of Economic and Social Affairs, Population Division.

**United Nations (1998).** *World Population Projections to 2150*. New York: Department of Economic and Social Affairs, Population Division.

**United Nations (2000).** *Long-range World Population Projections: Based on the 1998 Revision*. New York: Department of Economic and Social Affairs, Population Division.

**United Nations (2002).** *World Population Prospects: The 2000 Revision, Volume III: Analytical Report*. New York: Department of Economic and Social Affairs, Population Division.

**United Nations (2004a).** *World Population Prospects: The 2002 Revision, Volume III: Analytical Report*. New York: Department of Economic and Social Affairs, Population Division.

**United Nations (2004b).** *World Population to 2300*. New York: Department of Economic and Social Affairs, Population Division.

**United Nations (2011).** *World Population Prospects: The 2010 Revision, Volume I: Comprehensive Tables*. New York: Department of Economic and Social Affairs, Population Division.

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**United Nations (2013).** *World Population Prospects: The 2012 Revision, Volume I: Comprehensive Tables* (Vol. 1). New York: Department of Economic and Social Affairs, Population Division.

**United Nations (2014).** *World Population Prospects: The 2012 Revision, Methodology of the United Nations Population Estimates and Projections. Working Paper No. ESA/P/WP.235*. New York: Department of Economic and Social Affairs, Population Division.

**United Nations (2015a).** Extended Model Life Tables (version 1.3). New York: Department of Economic and Social Affairs, Population Division.

**United Nations (2015b).** *World Population Prospects: The 2015 Revision, Methodology of the United Nations Population Estimates and Projections* (ESA/P/WP.242). *Working Paper No. ESA/P/WP.242*. New York: Department of Economic and Social Affairs, Population Division.

**United Nations (2015c).** *World Population Prospects: The 2015 Revision, Volume I: Comprehensive Tables*. New York: Department of Economic and Social Affairs, Population Division.

**United Nations (2017a).** *World Population Prospects: The 2017 Revision, Methodology of the United Nations Population Estimates and Projections. Working Paper No. ESA/P/WP.250*. New York: Department of Economic and Social Affairs, Population Division.

**United Nations (2017b).** *World Population Prospects: The 2017 Revision, Volume I: Comprehensive Tables*. New York: Department of Economic and Social Affairs, Population Division.

**United Nations (2019a).** How certain are the United Nations global population projections? *Population Facts*. New York: Department of Economic and Social Affairs, Population Division. https://doi.org/10.1073/pnas.1713628115

**United Nations (2019b).** *World Population Prospects 2019: Highlights*. New York: Department of Economic and Social Affairs, Population Division.

**United Nations (2019c).** *World Population Prospects 2019: Methodology of the United Nations population estimates and projections. (ST/ESA/SER.A/425)*.