Forecast Tables: Introduction and Glossary

Forecasts (or simulation results) from International Futures are dynamic calculations of the full modeling system, not extrapolations of series, results of isolated multiple regressions, or representations of the forecasts of others. To understand more about the forecasts of IFs and the specific formulations for the variables shown in output tables, see Chapter 4 and the documentation of the model.

Forecasts are seldom made for individual countries over a long period of time. There are good reasons for the reluctance to provide such forecasts. For example:

- Data in any series are seldom available for all countries, particularly for smaller ones or those that have undergone substantial sociopolitical transitions. IFs represents 183 countries and uses estimation procedures to fill data holes as necessary.
- Every country is decidedly unique. Formulating a large-scale dynamic model to behave reasonably in the face of such complexity is extremely challenging, and structures of the system will never be completely free of poor behavior for many countries, especially under extreme or new circumstances.
- Some variables, such as the future level of democracy, have especially weak bases for forecasting.

Most longer-term global forecasting reduces the severity of these problems in several ways, such as by relying on regional aggregations of countries and significantly limiting the forecast horizon. The accompanying tables obviously ignore such practical approaches and simply present the numbers that the model produces. This volume has repeatedly stressed that we should never treat any model results as predictions; we should instead use them for thinking about and exploring possible futures. That is the spirit behind these tables. With continuing development of the modeling system, results will change and presumably improve on average. The project will give regular attention, in particular, to results that are extreme relative to other countries or to expectations based on regional expertise or other forecasts.

These forecast tables are organized by geographic, substantive, and temporal attributes. Geographically, the first of multiple sets begins with global and four-continent totals (Africa, the Americas, Asia with Oceania, and Europe), followed by subregional divisions within each of the continents (see maps that precede tables). The subsequent six pages of each set provide forecasts for each of the country members of the subregional divisions within the four continents. Within the subregional divisions, countries appear in descending order by forecasted population levels in 2060.

The multiple sets cover six substantive issue areas. The first provides population and population density information, and an overall measure of human well-being. The remaining sets of forecasting variables are divided into five categories: poverty (accompanied by standard economic variables such as GDP and GDP per capita), health, education, infrastructure, and governance. These categories correspond to the topics that this five-volume series will cover, and forecasts in each category will therefore be developed across volumes. At this time many of the health and infrastructure forecasts are very

preliminary, as those parts of the IFs system of models are the most-recently developed.

Temporally, each series contains values for 2010, 2030, and 2060, thereby providing a forecast horizon of fifty years. Additional columns for many variables show the cumulative percentage change from 2010 through 2060 and the annualized rate of change over the period. The model is currently initialized in 2005, and it computes annual results recursively from 2005 through the simulation horizon. Thus, results in years after 2005 are computations rather than actual values, even when data are available. The only exception is that IFs imposes the actual GDP 2005–2006 data on the model calculations so as to obtain accurate values for this key series. We will post new forecast sets online periodically.

To facilitate the reading and interpretation of the hard-copy tables associated with this volume and of the electronic copies on the IFs Web site (www.ifs.du.edu), we provide the variable names used in the tables, the variable name used in IFs, and some basic commentary on the variables, such as the sources of initial conditions and/or the forecast approach.

Variables	IFs Name	Source and Notes
Population, Land Area, and Human Development Index		
Population	POP	Total number of people within a country. Total initialized from WDI data with cohort data on age/sex distribution, fertility, and mortality from UN Population Division.
Land area in 1,000 sq kilometers	LANDAREA	Total national land area in 1,000 square kilometers, initialized with data from FAO via WDI. Constant over time.
Land area in 1,000 sq miles	No variable name in model; calculated by converting square kilometers	Total national land area in 1,000 square miles. Constant over time.
Population density per sq kilometer	No variable name in model; calculated from LANDAREA and POP	Population per land area measured in square kilometers.
Population density per sq mile	No variable name in model; calculated by converting density per square kilometer	Population per land area measured in square miles.
Urban population	No variable name in model; calculated from others	Percentage of population living in urban areas. Initialized with WDI data.
Population growth rate	POPR	Annual percentage change. See population.
Population below 15 years of age	POPLT15	The total number of people in this age category, which is generally considered a period of economic dependence on others.
Population 65 years of age and above	POPGE65	The total number of people in this age category, which is generally considered a period of nonparticipation in the labor force.
Youth bulge	YTHBULGE	Although the youth bulge is always an indicator of the portion of a population that is young, specific definitions vary. In IFs the definition is population 15–29 as a percentage of all adults (15 and older). A bulge exists when this ratio is above a specified level, such as 50 percent.
Human Development Index	HDI	This corresponds very closely to the UNDP's HDI (see http://hdr.undp.org), which is an average of three components: long and healthy life, knowledge (literacy and education), and standard of living (GDP/capita). Computed in IFs population model from nearly identical drivers within IFs (see Hughes 2004a for specifics).
HDI with higher ceilings	HDI21STFIX	An IFs-specific measure. Computed in IFs population model from driver categories within IFs corresponding to the UNDP's HDI but with maximum values raised to levels that constitute better upper limits for the twenty-first century, notably life expectancy of 120 and GDP per capita of $100,000 (see Hughes 2004a).

Variables	IFs Name	Source and Notes
Poverty		
Poverty (below $1 per day)	INCOMELT1LN	Population living below $1.08 per day at 1993 international prices (purchasing power parity). Initialized from the World Bank's PovCalNet. The forecasting formulation is based on an assumption that income in a country is subject to log-normal (LN) distribution, also responsive to the Gini index of distribution. There are complexities in the conversion of values from 1993 dollars to contemporary currency levels; although changes in the global consumer price index suggest that $1.08 in 1993 dollars would be $1.98 in 2000 dollars and $2.82 in 2005 dollars, the problems converting different countries with different market baskets and inflation patterns preclude such simple translation.
Poverty gap index	POVGAP	Average (normalized) income shortfall expressed as the average shortfall relative to a poverty line ($1 per day in IFs). The further below the poverty line incomes are, the greater the gap.
Poverty (below $2 per day)	INCOMELT2LN	Population living below $2.15 per day at 1993 international prices (purchasing power parity). Initialized from the World Bank's PovCalNet. See poverty below $1 for information.
Poverty (below $5 per day)	No variable name in model; calculated from others	Population living below $5.40 per day at 1993 international prices (purchasing power parity). See poverty below $1 for interpretation. The forecasts of values at income poverty levels above $2 per day do not use survey data for initial conditions but rather use the log-normal formulation and survey data for $2 per day to estimate initial conditions.
Poverty (below $10 per day)	No variable name in model; calculated from others	Population living below $10.80 per day at 1993 international prices (purchasing power parity). See poverty below $1 for general interpretation and poverty below $5 for a note on initialization.
Poverty (below $20 per day)	No variable name in model; calculated from others	Population living below $21.60 per day at 1993 international prices (purchasing power parity). See poverty below $1 for general interpretation and poverty below $5 for a note on initialization.
GDP per capita at PPP	GDPPCP	Gross domestic product at purchasing power parity (using 2000 dollars) divided by total population. See GDP for explanation of gross domestic product and GDPP for explanation of PPP.
Gross domestic product	GDP	Gross domestic product is defined as either the sum of value added across all sectors of an economy or as the sum of goods and services delivered to meet final demand of an economy. Initialized from WDI data using 2005 dollars; forecasts use much other data including series from the GTAP.
GDP at PPP	GDPP	The application of purchasing power parity to GDP. As OECD describes them, "Purchasing Power Parities (PPPs) are currency conversion rates that both convert to a common currency and equalize the purchasing power of different currencies. In other words, they eliminate the differences in price levels between countries in the process of conversion." Initialized from WDI data using 2000 dollars at purchasing power parity; forecasts use much other data including series from the GTAP.
Health		
Life expectancy at birth	LIFEXP	The average number of years a newborn is expected to live. Initialized from WDI data.
Infant mortality	INFMOR	The death rate of infants in the first year of life per 1,000 births. Initialized from WDI data.
Total fertility rate	TFR	The average number of children a woman is expected to bear throughout her life. Initialized from WDI data; forecasts initialized with cohort data on fertility from UN Population Division.
Calories per capita	CLPC	Calorie consumption per day from all sources, measured in kilocalories. Initialized with data originally from the UN FAO.
Malnourished children	MALNCHP	As defined by the World Bank, "The percentage of children under five whose weight for age is more than two standard deviations below the median reference standard for their age as established by the World Health Organization" and other bodies. Individual countries may look at children at ages three, four, or five. Initialized from WDI data using weight-based malnutrition measure.
AIDS death rate	AIDSDRATE	Deaths per thousand population per year. Initialized with data from UN AIDS.
Death rate: Digestive diseases	Not directly available in model; calculated as DEATHS by cause divided by population (POP)	Deaths per thousand population per year. Initialized with data from the WHO's Global Burden of Disease project.
Death rate: Respiratory diseases	Not directly available in model; calculated as DEATHS by cause divided by population (POP)	Deaths per thousand population per year. Initialized with data from the WHO's Global Burden of Disease project.

Variables	IFs Name	Source and Notes
Death rate: Other communicable diseases	Not directly available in model; calculated as DEATHS by cause divided by population (POP)	Deaths per thousand population per year. Initialized with data from the WHO's Global Burden of Disease project.
Death rate: Cardiovascular diseases	Not directly available in model; calculated as DEATHS by cause divided by population (POP)	Deaths per thousand population per year. Initialized with data from the WHO's Global Burden of Disease project.
Death rate: Malignant neoplasms	Not directly available in model; calculated as DEATHS by cause divided by population (POP)	Deaths per thousand population per year. Initialized with data from the WHO's Global Burden of Disease project.
Death rate: Other noncommunicable diseases	Not directly available in model; calculated as DEATHS by cause divided by population (POP)	Deaths per thousand population per year. Initialized with data from the WHO's Global Burden of Disease project. IFs forecasts do not include diabetes in the current tables.
Water safety	WATSAFE	Percentage of population with no access to improved drinking water. Initialized with data from WHO and UNICEF.
Sanitation	SANITATION	Percentage of population with no access to improved sanitation. Initialized with data from WHO and UNICEF.
Education		
Literacy	LIT	The basic definition is the ability of adults to read and write, but different countries use very different standards. IFs uses 15 and older as the definition of adult for this variable. Initialized from WDI data.
Years of education, Adults 25+	EDYRSAG25	Average number of years of education, presented separately for males and females 25 years of age and older. Initialized from the Barro and Lee dataset (Barro and Lee 2001).
Primary education enrollment rate, net	EDPRIENRN	The percentage of the official primary age group enrolled at the primary level. Contrast this with gross enrollment, which includes enrolled students from all age groups but maintains the base of the official age group and can therefore exceed 100 percent. Initialized with UNESCO data.
Primary education enrollment rate, gross	EDPRIENRG	All students of any age enrolled at the primary level as a percentage of those of the official age to enroll at the primary level. Contrast this with net enrollment, which considers only those enrolled who are of the official primary age. Initialized with UNESCO data.
Lower secondary enrollment rate, gross	EDSECLOWRENRG	All students of any age enrolled at the lower secondary level as a percentage of those of the official age to enroll at the lower secondary level. Lower secondary education for most countries is approximately grades 7–9. (See net primary enrollment for distinction between gross and net.) Initialized with UNESCO data.
Upper secondary enrollment rate, gross	EDSECUPPRENRG	All students of any age enrolled at the upper secondary level as a percentage of those of the official age to enroll at the upper secondary level. Upper secondary education for most countries is approximately grades 10–12. (See net primary enrollment for distinction between gross and net.) Initialized with UNESCO data.
Tertiary enrollment rate, gross	EDTERENRG	All students of any age enrolled at the tertiary level as a percentage of those of the official age (frequently considered to be 18–21) to enroll at the tertiary level. Initialized with UNESCO data.
Gender parity index: Primary education net enrollment	Not directly available in model; calculated as female enrollment rates over male enrollment rates	The ratio of the enrollment rate of females of official primary-level ages to the enrollment rate of males of official primary-level ages. Initialized with UNESCO data.
Gender parity index: Secondary education gross enrollment	Not directly available in model; calculated as female enrollment rates over male enrollment rates	The ratio of the secondary enrollment rate of females of all ages to the secondary enrollment rate of males of all ages. Initialized with UNESCO data.
Gender parity index: Tertiary education gross enrollment	Not directly available in model; calculated as female enrollment rates over male enrollment rates	The ratio of the tertiary enrollment rate of females of all ages to the tertiary enrollment rate of males of all ages. Initialized with UNESCO data.

Variables	IFs Name	Source and Notes
Infrastructure		
Water use per capita	WATUSEPC	Annual water withdrawals (all uses) divided by population. Initialized with data from FAO via WRI EarthTrends. Formulation in IFs is very basic and does not include feedback from water supply constraints.
Crop yield	YL	Annual agricultural crop production of all kinds divided by land area devoted to the production (metric tons per hectare). Initialized with production and land data ultimately from UN FAO.
Energy demand ratio to GDP	ENRGDP	Sometimes called energy intensity, and measured here as equivalent barrels of oil. The units of energy consumed per unit of GDP generally decrease as countries get richer. Initialized mostly using data from British Petroleum. A technology parameter heavily influences forecasts.
Carbon emissions	CARANN	Releases to the atmosphere of carbon from human activity (burning fossil fuels or deforestation) in billion tons or gigatons (1,000 million). Computed in IFs without initialization from a data source.
Road density	INFRAROAD	Defined as kilometers of road per 1,000 hectares. Initialized from WDI data.
Electricity use	INFRAELEC	Defined as kilowatt-hours per capita per year. Initialized from WDI data.
Telephone density	INFRATELE	Defined as telephone lines per 1,000 people. Initialized from WDI data and indirectly from ITU data.
Mobile phone usage	ICTMOBIL	Percentage access of population to mobile phones. Initialized from ITU data.
Internet usage	Not directly available in model; calculated from the number of networked people (NUMNWP) divided by POP	The percentage of the population with Internet access. Initialized mostly from ITU data.
Broadband usage	CTBROAD	Percentage access of population to broadband. Initialized from ITU data.
R&D expenditures	Not directly available in model; calculated as RANDDEXP over GDP	The OECD defines research and development to cover basic research, applied research, and experimental development; expenditures can be private or public. Initialized from OECD and WDI data and expressed here as a percentage of GDP.
Governance		
Freedom House Index (inverted)	FREEDOM	Freedom or democracy levels. This variable is based on and initialized from the well-known indicator from the Freedom House Freedom in the World series. Freedom House defines freedom as "the opportunity to act spontaneously in a variety of fields outside the control of government and other centers of potential domination." See www.freedomhouse.org. Coding of countries on separate civil and political liberty scales is done by experts. Inverted from Freedom House so that higher is more free (2–14).
Polity Democracy Index	DEMOCPOLITY	Democracy level, with attention to autocracy level. Based on and initialized from Polity Project data; see http://www.cidcm.umd.edu/polity. Historical values are coded by experts. Computed in IFs as the Polity measure of democracy (1–10 with highest most democratic) minus Polity autocracy (1–10 with highest most authoritarian) plus 10. This combined index measure is fairly widely used. See also FREEDOM.
Economic Freedom Index	ECONFREE	Initialized from Fraser International, which defines economic freedom as "the extent to which one can pursue economic activity without interference from government" and builds its index on several measures assessed by experts. Index range is 0–10, with higher values representing greater economic freedom. See http://www.freetheworld.com.
Government Corruption Perception Index	GOVCORRUPT	Based on and initialized from Transparency International's Corruption Perceptions Index. CPI is a composite index that draws on multiple polls and surveys. The index runs from 1–10, with higher values representing less corruption. See www.transparency.org.
Government Effectiveness Index	GOVEFFECT	Initialized from the World Bank's Governance Indicators Project Index, defined as "the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies." Rescaled from the original to run from 0 to 5 (most effective).
Knowledge Society Index	KNOWSOC	Based on A. T. Kearney/*Foreign Policy* knowledge subindex. Range runs from 0–100, with higher values indicating greater knowledge. See Hughes 2005, part 2, for specification tied to R&D spending and tertiary graduation rate.

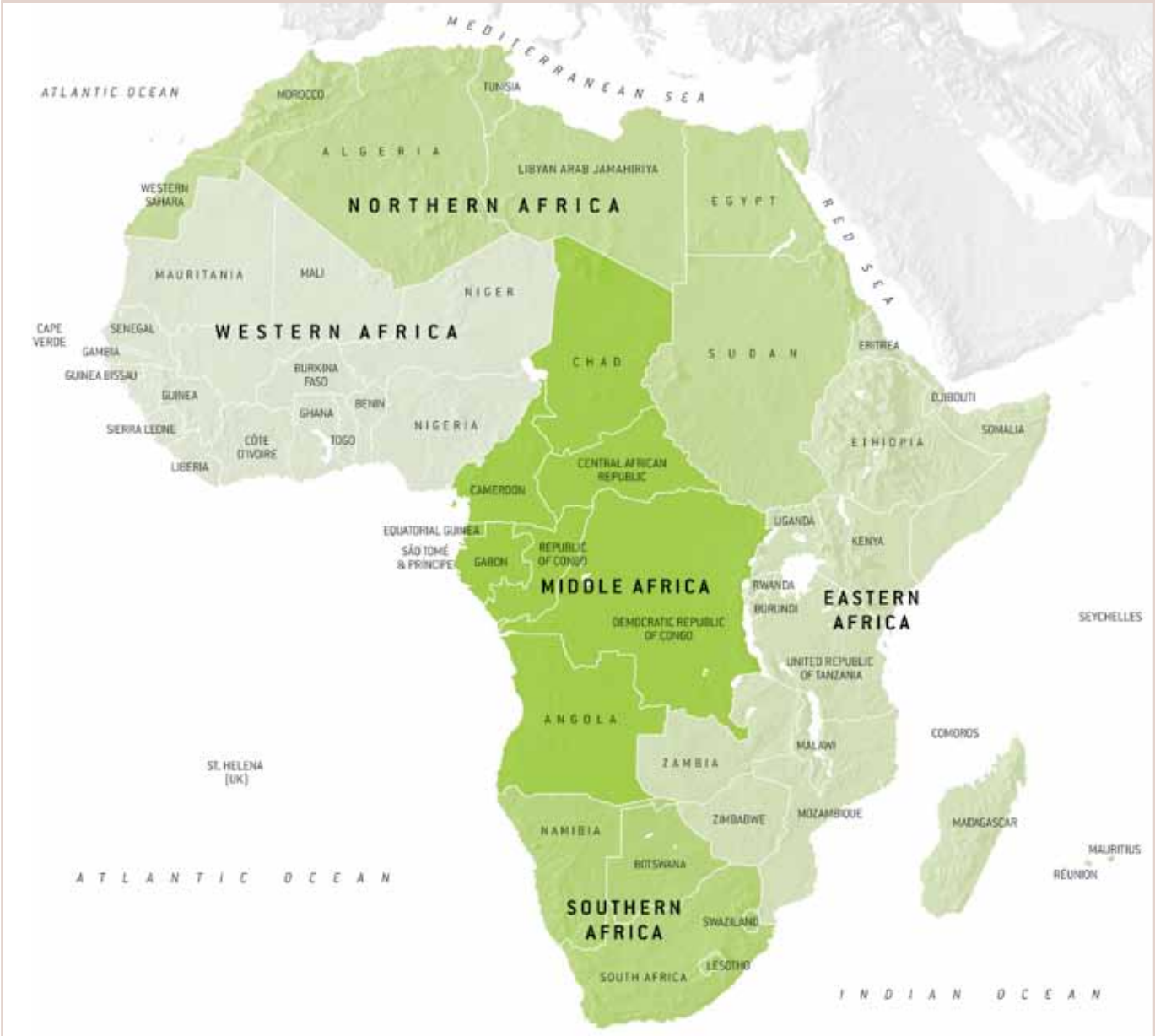
Variables	IFs Name	Source and Notes
Economic Integration Index	ECONINTEG	Based on A. T. Kearney/*Foreign Policy* globalization subindex, tied to trade and foreign direct investment flows. Values run from 0–100, with higher values representing greater economic integration. See Hughes 2005, part 2, for IFs specification.
Globalization Index	GLOBALIZ	Based on A. T. Kearney/*Foreign Policy* Globalization Index, built on four subindexes for economic integration, personal contact, technological connectivity, and political engagement. Index values extend from 0–100, with higher values representing greater globalization. See Hughes 2005, part 2, for specification in IFs.

Data Source Organization Abbreviations

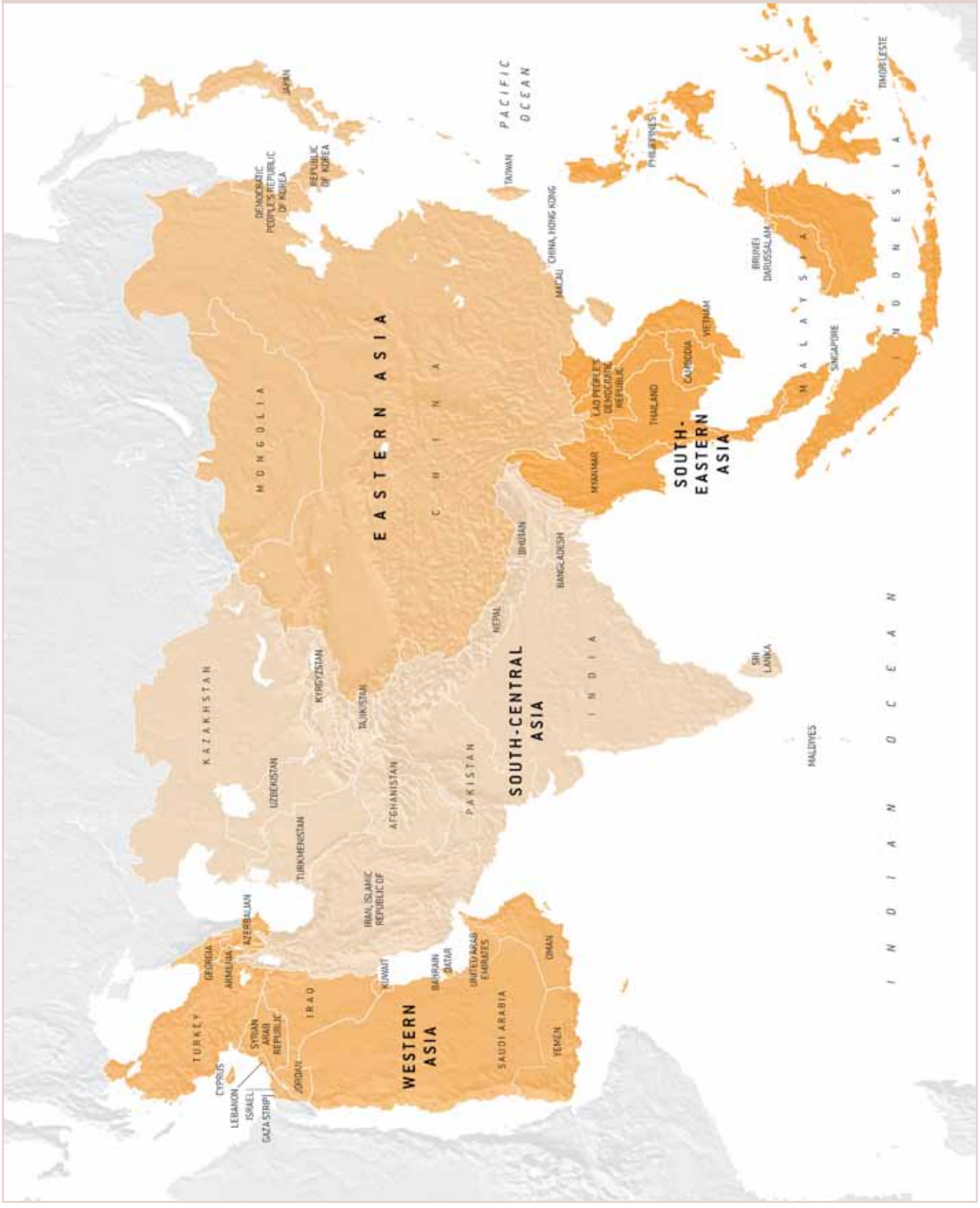
FAO	Food and Agriculture Organization of the United Nations
GTAP	Global Trade Analysis Project
ITU	International Telecommunications Union
OECD	Organization for Economic Cooperation and Development
UNAIDS	United Nations Program on AIDS
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UNICEF	United Nations Children's Fund
WDI	World Development Indicators of the World Bank
WHO	World Health Organization
WRI	World Resources Institute

Forecast Tables: Maps of Continents and Subregions

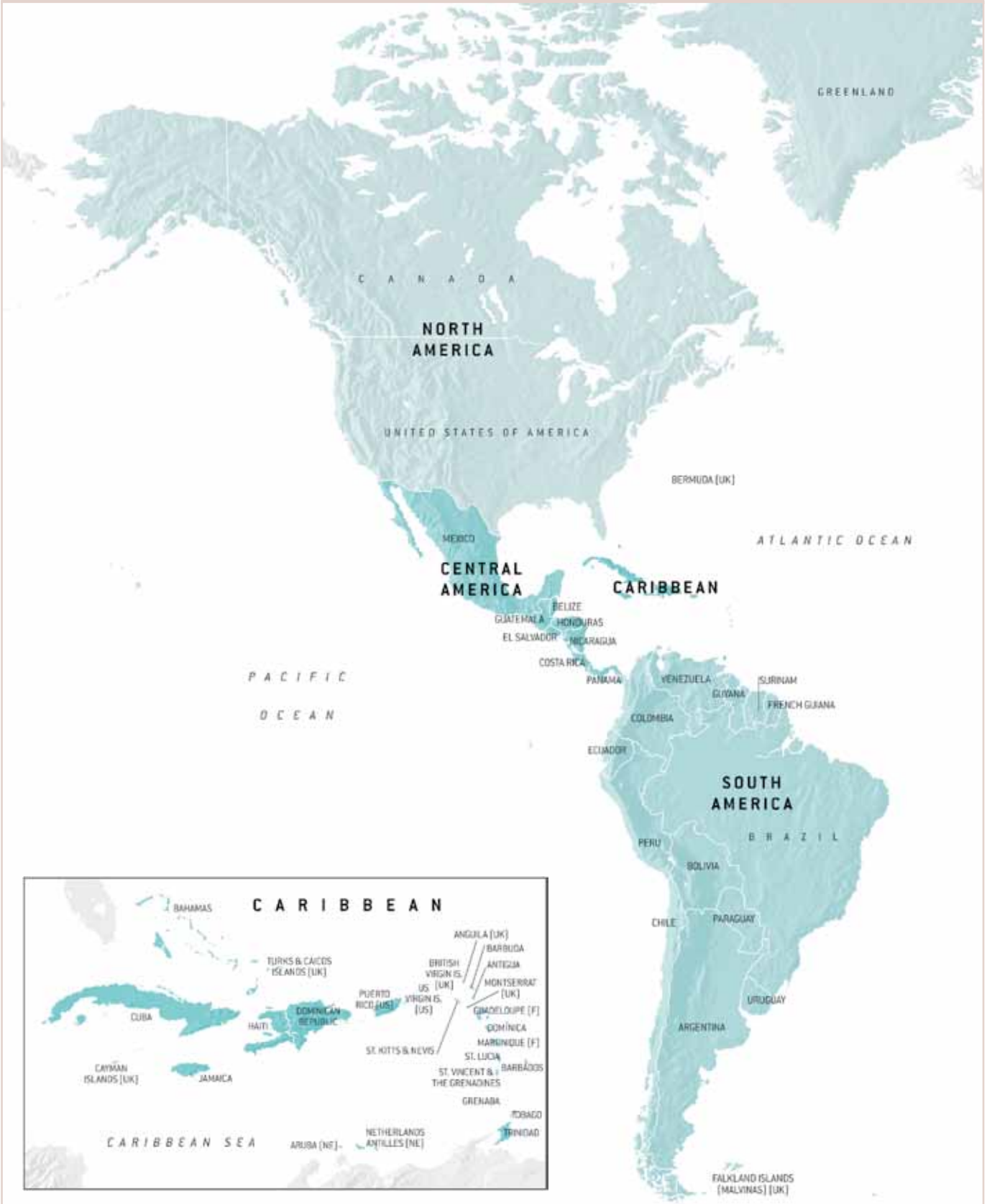
African regions



Asian regions



American regions



European regions