



**INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS**  
**UNION GEODESIQUE ET GEOPHYSIQUE INTERNATIONALE**

## **The IUGG Electronic Journal**

**Volume 16 No. 11 (1 November 2016)**

This informal newsletter is intended to keep IUGG Member National Committees informed about the activities of the IUGG Associations, and actions of the IUGG Secretariat. Past issues are posted on the IUGG website (<http://www.iugg.org/publications/ejournals/>). Please forward this message to those who will benefit from the information. Your comments are welcome.

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### **1. Mapping IUGG to Sustainable Development Goals**

Adopted by the UN General Assembly in 2015, the 2030 Agenda for Sustainable Development represents a new way of thinking about how to better link issues such as climate change, natural disasters and education. It intertwines social, economic, and environmental targets in 17 Sustainable Development Goals (SDGs; UN, 2015). Each of the SDGs is divided into several sub-goals. The interrelation between SDGs is not obvious, and one SDG can limit options or even clash with another SDG. The International Council for Science (ICSU) analyzed the complexity of interactions between different SDGs, and published a working paper that presents a tool to analyze and understand interactions between different goals<sup>1</sup>. “While the scientific community has emphasized the need for a systems approach to sustainable development, scientists, like policy-makers, are now facing the challenge of turning the goals into reality” (Nilsson et al., 2016).

Considering this issue important, I mapped IUGG and the Union Associations to the SDGs, to clarify how IUGG could contribute to the achievement of the goals. All the SDGs and sub-goals were divided into two groups: (i) those goals where IUGG can contribute, and (ii) goals where a potential contribution of the Union would be insignificant. Table 1 lists the 31 sub-goals to which IUGG could contribute. The sub-goals can be combined into several groups:

- air pollution (sub-goal 3.9),
- climate and environmental issues (1.5, 2.5, 3.9, 11.6, and 13.3),
- hazard and disaster risk (1.5, 2.5, 11.5, 11b, 13.1, and 15.3),

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<sup>1</sup> <http://www.icsu.org/publications/reports-and-reviews/working-paper-framework-for-understanding-sdg-interactions-2016/SDG-interactions-working-paper.pdf>

- education and capacity building (4.7, and 4b),
- energy (7a),
- gender (5.5),
- oceans and seas (14.1-14.3, 14a, and 14c),
- research and innovation (9.5, and 9b), and
- water issues (3.9, 6.3-6.7, 15.1, and 15.3).

From this mapping, it becomes clear that all Union Associations, the Union Commissions on Geophysical Risk and Sustainability (GeoRisk), Climatic and Environmental Change (CCEC), and Data and Information (UCDI) as well as the IUGG Committee on Capacity Building and Education could contribute to the sub-goals related to climatic change, natural hazards and risk, gender issues, education and capacity building, research and innovation. Particularly, the IAMAS Commission on Atmospheric Chemistry and Global Pollution<sup>2</sup> and the IAHS International Commission on Water Quality<sup>3</sup> could contribute to sub-goal 3.9 “to reduce the number of deaths and illnesses from ... air, water ... pollution and contamination”. The IASPEI-IAVCEI-IAPSO’s International Heat Flow Commission<sup>4</sup> could advance knowledge on geothermal energy. IAPSO and IAHS could contribute to the issues of oceans, seas and water. The next step is to analyze how IUGG and its Associations should work towards the implementation of the SDGs.

## References

- Nilsson, M., Griggs, D. and Visbeck, M. (2016). Map the interactions between Sustainable Development Goals. *Nature*, **534**, 320–322.
- UN (2015). Transforming our World: The 2030 Agenda for Sustainable Development. A/RES/70/1. United Nations, New York.

**Table 1. Mapping IUGG and Union Associations to the UN Sustainable Development Goals**

Goal	IUGG	IACS	IAG	IAGA	IAHS	IAMAS	IAPSO	IASPEI	IAVCEI
1.5	CCEC, GRC	✓	✓	✓	✓	✓	✓	✓	✓
2.4	CCEC, GRC	✓	✓		✓	✓	✓	✓	✓
3.9					✓	✓			
4.7	✓	✓	✓	✓	✓	✓	✓	✓	✓
4.b	CBEC	✓	✓	✓	✓	✓	✓	✓	✓
5.5.	✓	✓	✓	✓	✓	✓	✓	✓	✓
6.3, 6.7		✓				✓			
7.a					✓	✓	✓	✓	✓
9.5, 9.b	✓	✓	✓	✓	✓	✓	✓	✓	✓
9.6	✓	✓	✓	✓	✓	✓	✓	✓	✓
11.5	GRC	✓	✓	✓	✓	✓	✓	✓	✓
11.6	CCEC					✓			
11.b	GRC	✓	✓	✓	✓	✓	✓	✓	✓
13.1	CCEC, GRC	✓	✓	✓	✓	✓	✓	✓	✓
13.3	CCEC	✓			✓	✓	✓		
14.1-14.3							✓		
14.a, 14.c							✓		
15.1		✓			✓	✓		✓	
15.3	GRC				✓	✓			
16.6, 16.7	✓	✓	✓	✓	✓	✓	✓	✓	✓
17.6	✓	✓	✓	✓	✓	✓	✓	✓	✓
17.16	✓								
17.18	UCDI		✓	✓			✓		

The relevant SDGs are listed in Appendix 1 at the end of this issue of the journal.

Alik Ismail-Zadeh, IUGG Secretary General

<sup>2</sup> <http://www.icacgp.org/>

<sup>3</sup> <http://paramo.cc.ic.ac.uk/iahs>

<sup>4</sup> <http://www.iaspei.org/commissions/iaspei-iaivcei-iaga-iapso-iamas-iahs-international-heat-flow-commission>

## 2. Report on the 15<sup>th</sup> IUGG-SEDI Symposium 2016

SEDI is the IUGG Union Commission dedicated to the Study of the Earth's Deep Interior. SEDI holds biennial symposia, and this year's very successful 15<sup>th</sup> SEDI meeting was held in Nantes, France, from 24 to 29 July. There were 205 registered participants, of whom 66 were either students or within a year of PhD graduation. 20 countries were represented (but many more nationalities). Following the well-established structure for SEDI meetings, each half-day session consisted of an invited review followed by two research talks, leaving plenty of time for viewing the 175 posters (which were on display for the full week of the meeting) during the coffee breaks (with local specialties such as pancakes) and general discussion sessions, led by the session Chair. The sessions were *on Mantle Structure and Composition; Mantle History and Dynamics; Outer Core Observations, structure, composition; Outer Core Dynamics and Modelling; Core-Mantle Boundary; Other Planets: Observations; Other Planets: Modelling; and Inner Core*. The Zatman lecture is given at each SEDI meeting by a prominent young scientist who has done outstanding work on core dynamics. Stephen Zatman was himself a prominent young scientist who studied core dynamics, and whose life was tragically cut short. This year's lecture was given by Alexandre Fournier (Institut de Physique du Globe, Paris) as the review talk in the *Outer Core Dynamics and Modelling* session. In addition, Philippe Cardin (University of Grenoble) gave an evening public lecture, entitled *Journey(s) Deep Inside a Planet* (the title reflecting that Nantes was the birthplace of Jules Verne).



*Group photo of the SEDI Symposium participants (photo: Kathy Whaler)*

The organization and social aspects of the meeting were first-rate. As always, this was an ideal meeting for early-career and more senior scientists alike to present and share results, and discuss key topics on the interiors of Earth and other solar system objects. The conference center offered excellent poster space next to the lecture hall. The icebreaker was held at the Natural History Museum, with a complimentary tour of the Museum. On Wednesday in the afternoon there was a choice of excursions: either a walking tours of Nantes, or a tour of the historic nearby town of Clisson followed by a visit to a local Loire vineyard. This was followed by a boat trip up the Erdre river, during which aperitifs were served, to the Chateau de la Poterie for the conference dinner.

The SEDI Business Meeting was held on 28 July. North America was chosen as the location for the next meeting. Three venues (two in the USA and one in Canada) were identified. SEDI members will make the final decision at a later stage. SEDI awards Doornbos Memorial Prizes to young scientists, in honor of the Dutch seismologist, Durk Doornbos, for outstanding work on the Earth's deep interior. This year's prizes were given to Kumiko Hori (University of Leeds), Chris Davies (University of Leeds) and Shigehiko Tateno (Okayama University).

IUGG funds supported 12 early-career scientists to attend the meeting. A further 12 were supported by the US NSF and Japanese funds.

Kathy Whaler, IUGG Vice-President

### 3. Report on the 31<sup>st</sup> Conference on Mathematical Geophysics 2016

The IUGG Union Commission on Mathematical Geophysics (CMG) held its 31<sup>st</sup> Conference during 6-10 June at Université Pierre et Marie Curie in Paris, France. The CMG biennial meetings take place all over the world and cover key contemporary issues in mathematical geophysics, embracing the solid Earth, ocean, atmosphere, climate, planetary, engineering, and applied math communities. This year's meeting had a strong emphasis on computational and experimental science. In particular, it reached out to experimental science communities via a special session on "*Experimental Geophysics*", which focused on bridging the gap between theory and field observation. The scientific program included 16 special sessions divided into four thematic blocks: *Earth System and Planets*, *Fluids and Granular Flows*, *Seismology*, *Tectonics and Rock Mechanics*, and *Cross Disciplinary Approached, Methods, and Data*.



CMG 2016 Meeting participants (photo: Renaud Toussaint)

The meeting featured invited plenary talks by Maria T. Zuber, Department of Earth, Atmospheric and Planetary Sciences, Massachusetts Institute of Technology, on *Advances in Planetary Gravity Mapping* and by Chris Paola, Department of Earth Sciences and St. Anthony Falls Laboratory, University of Minnesota on *Using Unscaled and Partially Scaled Experiments in Geophysics*.

Each session included talks by several invited speakers, as well as contributed talks and posters. The meeting was attended by 218 researchers, postdocs, and students from 23 countries, including France (98 participants), USA (24), UK (17), Australia (11), Netherlands (11), Germany (7), and Switzerland (6). The social program included a field trip "*Geology of Paris: the birth of a capital*", organized by young geologists of the Institut de Physique du Globe de Paris (IPGP). The CMG 2016 Local Organizing Committee co-chaired by Philippe Claudin (CNRS, École Supérieure de Physique et Chimie Industrielles), Alexandre Fournier (IPGP), Valérie Vidal (CNRS, École normale supérieure de Lyon), and Renaud Toussaint (CNRS, Institut de Physique du Globe, Strasbourg). Additional information and detailed meeting program is available at: <https://cmg2016.sciencesconf.org>.

The IUGG Union Commission on Mathematical Geophysics received five excellent proposals for holding the 32<sup>nd</sup> CMG meeting in 2018. Considering the potential for close interaction between participants, expanding scientific collaborations, availability of sponsorship and support to young scientists, and overall readiness by the local organizing committee, the IUGG-CMG Executive Committee selected the Russian proposal to hold the CMG 2018 in Russia on a conference boat cruising from the city of Nizhny Novgorod to St. Petersburg along the Volga River, lakes Onega and Ladoga, through ancient cities and historical places of Gorodets, Yaroslavl, Kizhi, and Valaam.

Ilya Zaliapin, IUGG-CMG Secretary

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#### **4. News from the International Council for Science (ICSU)**

##### ***ICSU and ISSC to merge into a new international science council***

“The world faces great challenges and society increasingly looks towards science to address them. This places demands on all fields of science in all parts of the world. It compels a global response, involving strengthened collaboration within the international scientific community and between it and the world of policy and business, civil society, and the public at large” (from the letter of the Presidents of the ICSU and the International Social Science Council - ISSC). The ICSU Executive Board and the ISSC Executive Committee decided to consult their members on the possibility of merging the two Councils. Thus, an extraordinary ICSU General Assembly was held in Oslo, Norway, on 24 October 2016 jointly with the ISSC. The decision of the joint Assembly was to approve the merger in principle and to allow the two Councils to develop a strategic and transition plans for setting up a new international science council. 77% of the ICSU Members and 87% of the ISSC Members voted in favor of a future merger of the two organizations. The final decision on the merger will be taken by the membership of ICSU and ISSC at the ordinary General Assembly of ICSU in October 2017.

##### ***ICSU and UNESCO to collaborate on science advice***

ICSU and UNESCO formalized a partnership on one of the fastest growing areas of public science endeavor – the provision of science advice for public policy. Flavia Schlegel, UNESCO's Assistant Director-General for Natural Sciences and Heide Hackmann, Executive Director of ICSU, signed an agreement committing the two agencies to assist countries by the development and/or strengthening of advisory systems, particularly in the developing world; to enable improved dialogue between scientific and policy communities, with linkages between research programs and policy needs; and to provide a forum for policy makers, practitioners, national academies and academics to develop and enhance approaches to the use of scientific evidence in informing policy at all levels of government. This collaboration will be operationalized through the International Network of Global Science Advice (INGSA), which operates under the auspices of ICSU. The founding Chair of INGSA is Sir

Peter Gluckman, Chief Science Advisor to the Prime Minister of New Zealand. More information about INGSA and practical information about science advice to governments can be found at [www.ingsa.org](http://www.ingsa.org).

### ***Académie des Sciences celebrated its 350th anniversary***

The Académie des Sciences is a founding Member of IUGG and ICSU and has always had strong links with the Council and the Union. The 350<sup>th</sup> anniversary event was held in the auditorium of the Musée du Louvre in Paris. The celebration commenced with addresses by Bernard Meunier, President of the Académie des Sciences, Catherine Brechignac, Secrétaire Perpétuel of the Académie, Lamberto Maffei, Vice-President of the Accademia Nazionale dei Lincei, Volker Ter Meulen, President of the InterAcademy Partnership, and Gordon McBean, ICSU President. This was followed by an address by French President François Hollande. In his address to the event, President Hollande linked the scientific enterprise to the ideal of progress, which he said is both a goal and a value. He said: “Science is progress. We must promote it and rehabilitate it in the face of the challenges of growth and human development.”

### ***Urgencies in Fundamental Climate Research following the Paris Agreement***

An event titled “Urgencies in Fundamental Climate Research following the Paris Agreement” has been organized for COP22 in Marrakesh, Morocco, by ICSU together with the Scientific Committee on Antarctic Research (SCAR), the Inter-American Institute for Global Change Research (IAI), the World Climate Research Programme (WCRP), and the Intergovernmental Panel on Climate Change (IPCC) Working Group I will address fundamental questions facing climate researchers. Rapid progress on these challenging issues will inform upcoming assessments, providing a basis for future stock-taking and scientific and political action. The event will take place on 7 November 2016, 15:00-16:30, in the Mediterranean Room, in the Bab Ighli Blue Zone, and will also be livestreamed on YouTube (<http://bit.ly/2dgOnPN>).

### ***Call for experts to review a draft report on enhanced understanding of interactions across the Sustainable Development Goals***

ICSU is leading the preparation of a report on interactions across the Sustainable Development Goals (SDGs) to be published in early 2017. The report aims to provide a tool for scientists, policymakers and practitioners to explore how the SDGs puzzle fits together and how it can be implemented following an integrated approach. It builds upon the *Review of targets for the Sustainable Developments Goals: the science perspective* published in early 2015. The report will demonstrate how to better analyze and understand SDG interactions by applying a seven-point scale typology that characterizes the range of positive and negative interactions that can occur between targets and goals, and additional dimensions such as governance, geography or technology. ICSU is looking for scientists with expertise spanning several SDGs to peer review part or all of the report between November 2016 and January 2017. Reviewers should have: (i) broad knowledge of the Sustainable Development Goals and understanding of the process that led to their definition, (ii) specific expertise in at least one of the SDG areas covered in the report (agriculture and nutrition, health, energy, oceans) and the interplay between economic, social and environmental dimensions within these. Individual SDG chapters are about 30 pages each. Reviewers will not be remunerated. Specific template and guidelines for review will be provided. To register your interest to review a chapter or the full report, please fill in the online form <https://www.surveymonkey.com/r/PHQLS72>. Deadline for registration: 14 November 2016

Source: ICSU website

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## 5. Awards and honors

IUGG Fellow **John P. Burrows**, Chair of the IAMAS Intl. Commission on Atmospheric Chemistry and Global Pollution, was elected Fellow of the Royal Society.

**Igor Mokhov**, Past Bureau Member of IAMAS, was elected Full Member of the Russian Academy of Sciences.

**Marcia McNutt**, President of the U.S. National Academy of Sciences (IUGG Adhering Body), was elected Foreign Member of the Russian Academy of Sciences.

**Anatoly Soloviev**, Member of the IUGG Union Commission on Data and Information, and Chair, IAGA Interdivisional Commission on History, was elected Corresponding Member of the Russian Academy of Sciences.

Congratulations to Marcia, Anatoly, Igor and John!

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## 6. Obituary: James J. O'Brien (1935-2016)



IUGG Fellow James J. O'Brien, Professor Emeritus of Meteorology/Physical Oceanography in the Department of Earth, Ocean and Atmospheric Science at Florida State University (FSU), died peacefully on 20 September 2016 at Tallahassee Memorial Hospital from complications following open heart surgery. Prof. O'Brien, the Robert O. Lawton Distinguished Professor of Meteorology and Oceanography, founded the Center for Ocean-Atmospheric Prediction Studies at FSU. He served as a weather officer in the U.S. Air Force from 1958 to 1960, promoted to the rank of Captain. He took advantage of the Air Force's financial assistance and training to earn both his Masters (1964) and Ph.D. (1966) degrees in Meteorology at Texas A&M University. He is internationally known for mentoring young scientists, and under his guidance, 44 students completed their Ph. D. degree and over 80 students completed their M.S. degree. He was particularly proud of his success in dramatically increasing the number of women scientists in oceanography and meteorology. Once nicknamed "Dr. El Niño", he was a pioneer in using early supercomputers to model atmospheric and oceanic interactions which led to new breakthroughs in understanding and prediction of coastal upwelling, El Niño, La Niña, and hurricane effects on the ocean. Prof. O'Brien served as the President of the International Association for Physical Sciences of the Oceans (IAPSO), from 1987 to 1991, and retired in December 2006 after 38 years at Florida State. He will be sadly missed by the oceanographic community.

Denise Smythe-Wright, IAPSO President

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## 6. Meeting calendar

A calendar of meetings of interest to IUGG disciplines (especially those organized by IUGG Associations) is posted on the IUGG website (<http://www.iugg.org/calendar.php>). Individual Associations also list more meetings on their websites according to their disciplines.

## November

- 7-10, GEO, St. Petersburg, Russia, Plenary XIII of the Group on Earth Observations. Web: <https://www.earthobservations.org/geo13.php>
- 14-18, ICTP, IUGG, San Jose, Costa Rica, Second Workshop on Climate Change, Variability and Modeling over Central America and Mexico. Web: <http://indico.ictp.it/event/7621>
- 13-17, IAHS, Shenzhen and Wuhan, China, International Workshop on Hydrological Knowledge Innovation and its Practices in Developing Countries. Web: [http://iahs.info/uploads/Meetings/Workshop%20Announcement\\_2016\\_HKIPDC.pdf](http://iahs.info/uploads/Meetings/Workshop%20Announcement_2016_HKIPDC.pdf)
- 16-18, IAG, Quito, Ecuador, Sub-commission 1.3b Reference Frame for South and Central America (SIRGAS) Symposium 2016. Web: <http://www.igm.gob.ec/sirgas/>
- 20-25, IAVCEI, Puerto Varas, Chile, Cities on Volcanoes 9. Web: <https://www.citiesonvolcanoes9.com/en/>
- 21, IAHS, Frascati, Italy, MOXXI 2016 – Measurements and Observations in the 21st Century Conference. Web: <http://iahs.info/Commissions--W-Groups/Working-Groups/MOXXI/Information/AGU-2015/>
- 21-25, IAG, Quito, Ecuador, SIRGAS School on Vertical Reference Systems. Web: <http://www.igm.gob.ec/sirgas/>

## December

- 12-16, AGU, San Francisco, CA, USA, Fall Meeting of the American Geophysical Union. Web: <https://fallmeeting.agu.org/2016/>

## January 2017

- 22-26, AMS, Seattle, WA, USA, The Annual Meeting 2017 of the American Meteorological Society. Web: <https://annual.ametsoc.org/2017/>
- 23-25, ICTP, IUGG, Antigua, Guatemala, Conference on the Science of Climate Change: a focus on Central America and the Caribbean Islands. Web: <http://indico.ictp.it/event/7949/>

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## Appendix 1. The SDGs and sub-goals related to IUGG activities

Note: only those SDGs and sub-goals related to IUGG activities are listed below, and the *italic font* highlights the topics of interest to IUGG.

### **Goal 1. End poverty in all its forms everywhere**

**1.5** By 2030, build the resilience of the poor and those in vulnerable situations and *reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters.*

### **Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture**

**2.4** By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that *strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.*

### **Goal 3. Ensure healthy lives and promote well-being for all at all ages**

**3.9** By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and *air, water and soil pollution and contamination.*

### **Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all**

**4.7** By 2030, *ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable*

lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development;

**4.b** By 2020, substantially *expand globally the number of scholarships available to developing countries, in particular least developed countries, small island developing States and African countries*, for enrolment in higher education, including vocational training and information and communications technology, technical, engineering and scientific programmes, in developed countries and other developing countries.

**Goal 5. Achieve gender equality and empower all women and girls**

**5.5** *Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life.*

**Goal 6. Ensure availability and sustainable management of water and sanitation for all**

**6.3** By 2030, *improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally;*

**6.4** By 2030, substantially increase water-use efficiency across all sectors and *ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity;*

**6.5** By 2030, *implement integrated water resources management at all levels, including through transboundary cooperation as appropriate;*

**6.6** By 2020, *protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes;*

**6.7** By 2030, *expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies.*

**Goal 7 Ensure access to affordable, reliable, sustainable and modern energy for all**

**7.a** By 2030, *enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.*

**Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation**

**9.5** *Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending;*

**9.b** *Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities.*

**Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable**

**11.5** By 2030, *significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations;*

**11.6** By 2030, *reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management;*

**11.b** By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and *develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels.*

**Goal 13. Take urgent action to combat climate change and its impacts**

**13.1** *Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries;*

**13.3** *Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning.*

**Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development**

**14.1** By 2025, *prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution;*

**14.2** By 2020, *sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts*, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans;

**14.3** *Minimize and address the impacts of ocean acidification*, including through enhanced scientific cooperation at all levels;

**14.a** *Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries;*

**14.c** *Enhance the conservation and sustainable use of oceans and their resources* by implementing international law as reflected in UNCLOS, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of The Future We Want.

**Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss**

**15.1** By 2020, *ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands*, in line with obligations under international agreements;

**15.3** By 2030, *combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world*.

**Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels**

**16.6** *Develop effective, accountable and transparent institutions* at all levels;

**16.7** *Ensure responsive, inclusive, participatory and representative decision-making* at all levels.

**Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development**

**17.6** *Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism;*

**17.16** *Enhance the global partnership for sustainable development*, complemented by multi-stakeholder partnerships that *mobilize and share knowledge, expertise, technology and financial resources*, to support the achievement of the sustainable development goals in all countries, in particular developing countries;

**17.18** By 2020, *enhance capacity-building support to developing countries*, including for least developed countries and small island developing States, *to increase significantly the availability of high-quality, timely and reliable data* disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts.

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Editors: Tom Beer, Alik Ismail-Zadeh (Editor-in-Chief), Franz Kuglitsch (Associate Editor), and Kathryn Whaler.

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