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Author/s:

Keywood, M;Paton-Walsh, C;Lawrence, M;George, C;Formenti, P;Schofield, R;Cleugh, H;Borgford-Parnell, N;Capon, A

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Title: The atmosphere – the invisible sphere in the sustainable development goals

Authors: M. Keywood^{1*†}, C. Paton-Walsh^{2‡}, C. George³, P. Formenti⁴, M. Lawrence⁵, R. Schofield⁶, H. Cleugh⁷, N. Borgford-Parnell⁸, T. Capon⁹.

5 **Affiliations:**

¹CSIRO Oceans & Atmosphere, Melbourne, Australia.

² Univ of Wollongong, Centre Atmospheric Chemistry, Wollongong, Australia.

³CNRS, Inst Recherche Catalyse & Environment Lyon, France.

⁴ Univ Paris Cite, Paris, France.

10 ⁵ IASS, Potsdam, Germany.

⁶ Univ Melbourne, , ARC CoE Climate Extremes, Melbourne, Australia.

⁷ CSIRO Oceans & Atmosphere, Canberra, Australia.

⁸ UNEP, Climate & Clean Air Coalition, Paris, France.

⁹ Monash Univ, Monash Sustainable Dev Inst, Melbourne, Vic, Australia.

15 [†] President International Commission for Atmospheric Chemistry and Global Pollution.

[‡] Co-Chair International Global Atmospheric Chemistry Project.

20 The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, is structured into 17 Sustainable Development Goals (SDGs), which are an urgent call for global action towards a sustainable future. Atmospheric chemistry and composition underlie the most significant existential threats to humans (climate change and ozone depletion) (1) and poor air quality represents the greatest environmental health issue in the modern world (2), yet the atmosphere is hardly mentioned in the SDGs. There are SDGs for food and water (SDG 2 Zero Hunger and SDG 6 Clean Water and Sanitation), but no SDG for air. However, humans can live for approximately 3 weeks without food, 3 days without water but only 3 minutes without air. Similarly, there are SDGs for the marine and continental biospheres (SDG 14 Life Below Water and SDG 15 Life on Land), but no SDG for the atmosphere.

30 The only explicit references to atmospheric composition relate to air pollution (SDG 3 Good Health and Wellbeing and SDG 11 Sustainable Cities and Communities), where indicators around mortality rates and annual fine particulate levels are specified, even though air quality is relevant to many other SDGs (3). Metrics for reduction of atmospheric pollutants are needed along with goals that explicitly address ozone chemistry, heatwaves and the atmospheric transmission of pathogens (4). Furthermore, SDG 13 Climate Action refers to the United Nations Framework Convention on Climate Change as being primarily responsible for mitigating climate change. Surprisingly, however, the atmosphere is not explicitly mentioned in the 2015 Paris Agreement, the main current instrument of the UNFCCC. Reference is made to greenhouse

gases, but not to atmospheric composition, nor to particulate matter or shorter-lived climate-forcing pollutants.”

Atmospheric composition and chemistry are inherently important to many other SDGs that make no explicit mention of it, such as:

- 5 • SDG 2 Zero Hunger: Agricultural yields are decreased by air pollutants such as ozone (5) and by climate warming caused by greenhouse gases (6).
- SDG 7 Clean Energy: Stationary power generation is a major source of air pollutants, so air quality and human health are significant additional incentives for transitioning to renewable energy.
- 10 • SDG 9 Industry, Innovation and Infrastructure: Advances in these areas will be key to reducing emissions of greenhouse gases and pollutants to the atmosphere in future.
- SDG 10 Reduced Inequality: Access to clean air to breathe is a major contributor to health inequalities with poorer populations often exposed to the worst air pollution (7).
- 15 • SDG 12 Responsible Consumption and Production: Production processes cause a range of emissions to the air, including greenhouse gases, ozone depleting substances, persistent organic pollutants, mercury and other air toxins.
- SDG 15 Life on Land: Life is only possible because of a healthy atmosphere including the ozone layer.

20 The atmosphere may be largely invisible, but it is nevertheless of fundamental importance to a sustainable future; therefore, United Nations policy beyond 2030 should include explicit objectives for a healthy atmosphere. The SDGs were put together by delegates and expert advisors who envisaged a better future for 2030. However, if atmospheric research fails to be supported because its importance for achieving the SDGs is not clearly recognised, then this
25 vision for a more sustainable future will not be realized

References and Notes

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45 **Author contributions:** Each author’s contribution(s) to the paper should be listed [we encourage you to follow the [CRediT](#) model]. Each CRediT role should have its own line, and there should not be any punctuation in the initials.

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Conceptualization: MK, CG, CP-W, PF

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Writing – review & editing: CG, MK, CP-W, PF, RS, HC, NB-P, TC