Enhancing Environmental Sustainability in South Africa: Insights from the ESGAP Framework

Webinar Launch

23 October 2025

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bc3 BASQUE CENTRE FOR CLIMATE CHANGE Klima Aldaketa Ikergai

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CST Centre for Sustainability Transitions

SAIIA 90 YEARS EST.1934

The need for strong sustainability measures: the ESGAP framework

Presentation to the South African ESGAP seminar

Professor Paul Ekins

UCL Institute for Sustainable Resources

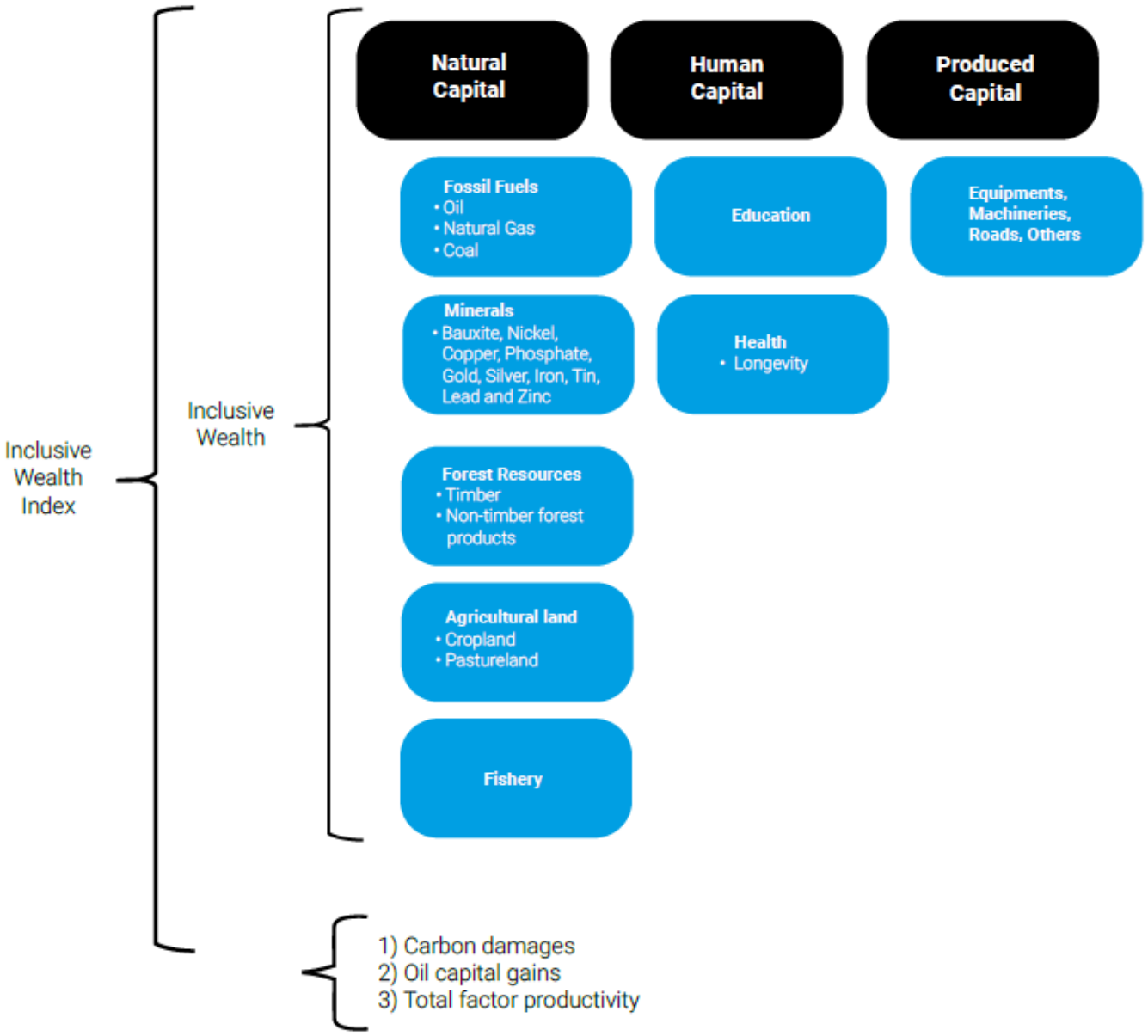
University College London

online October 23rd, 2025

Two worldviews (1)

Weak sustainability

- The underlying principle of a weak sustainability approach is that there is broad substitution between different forms of 'capital': "[E]conomic development is sustainable over a period of time if net investment in the economy's stock of assets is positive during the period. That is net investment in the *aggregate*, which means that even if stocks of some capital goods were to decline (in quantity or quality, or both), net investment would be positive if sufficient investment were made towards the accumulation of the remaining assets." (Prof. Partha Dasgupta, Foreword to *Inclusive Wealth Report 2018*, p.ix)
- This has led to massive substitution of physical (manufactured) and human capital for natural capital (i.e. resources and the environment).

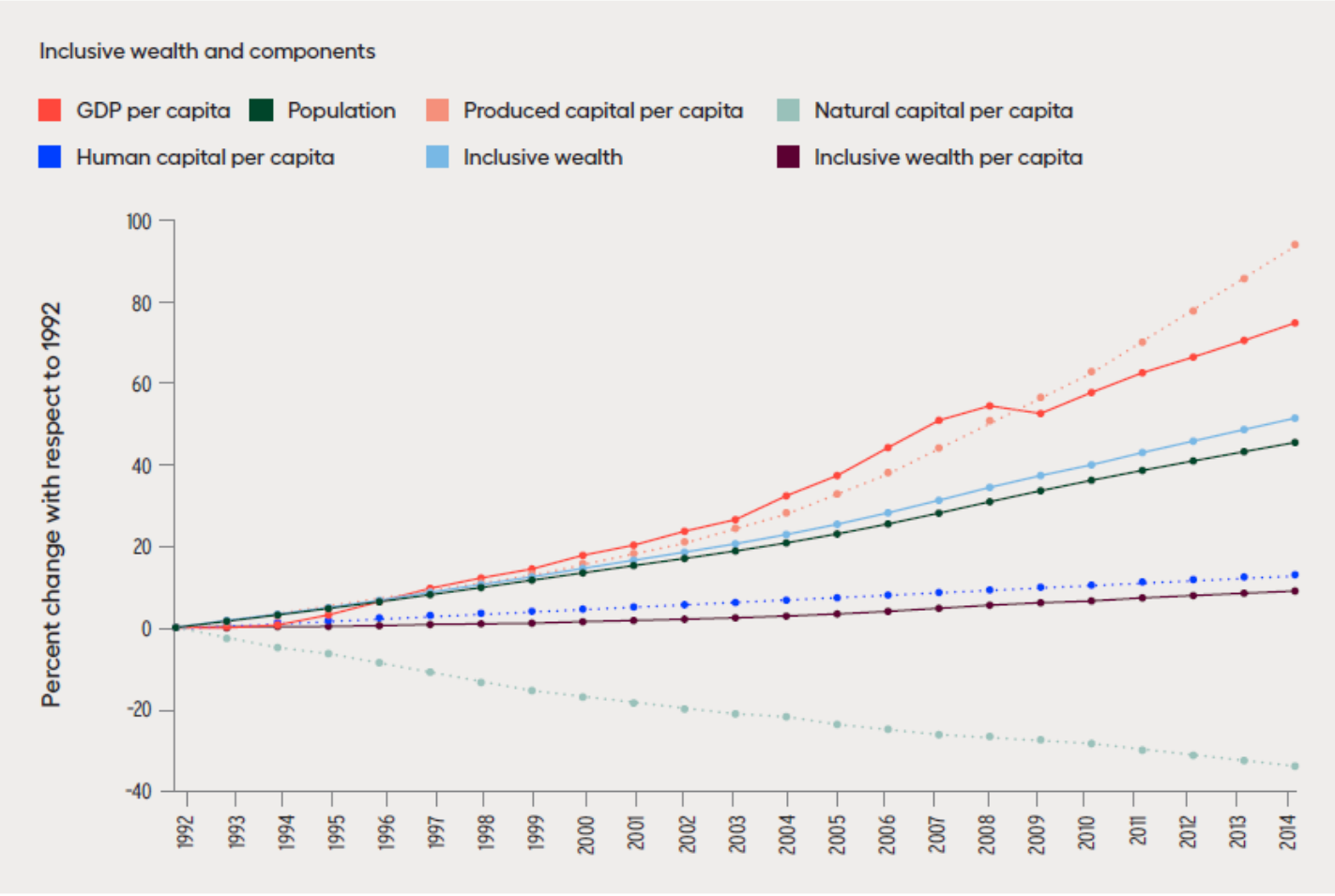


Inclusive Wealth

Source: Inclusive Wealth Report 2018, Figure 1.2, p.5

Natural capital in Inclusive Wealth 2018: systematic depletion of resources

Figure 7.3 The steady decline in natural capital



Source: UNEP 2018b.

Source: UNDP Human Development Report 2020, https://hdr.undp.org/sites/default/files/hdr2020.pdf

FIGURE 2B.1 Adjusted Net Saving for East Asia and Pacific, 1995–2015

percentage of gross national income

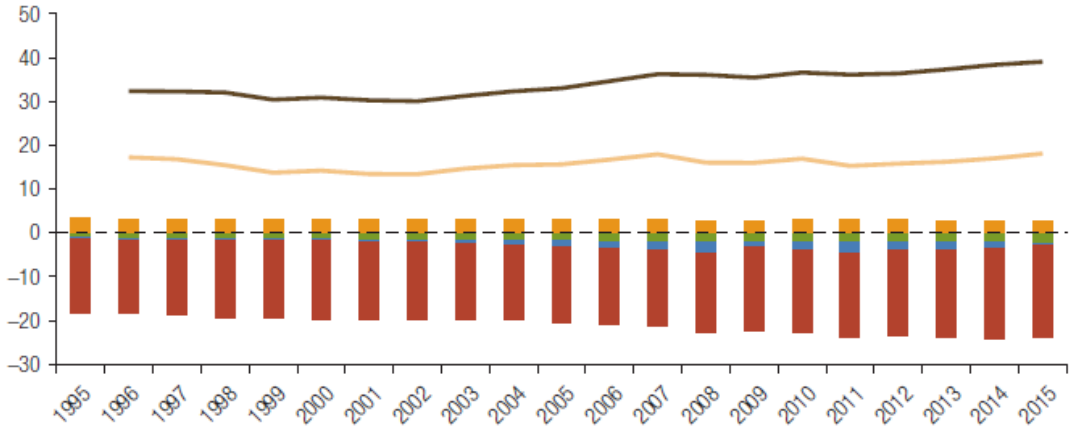
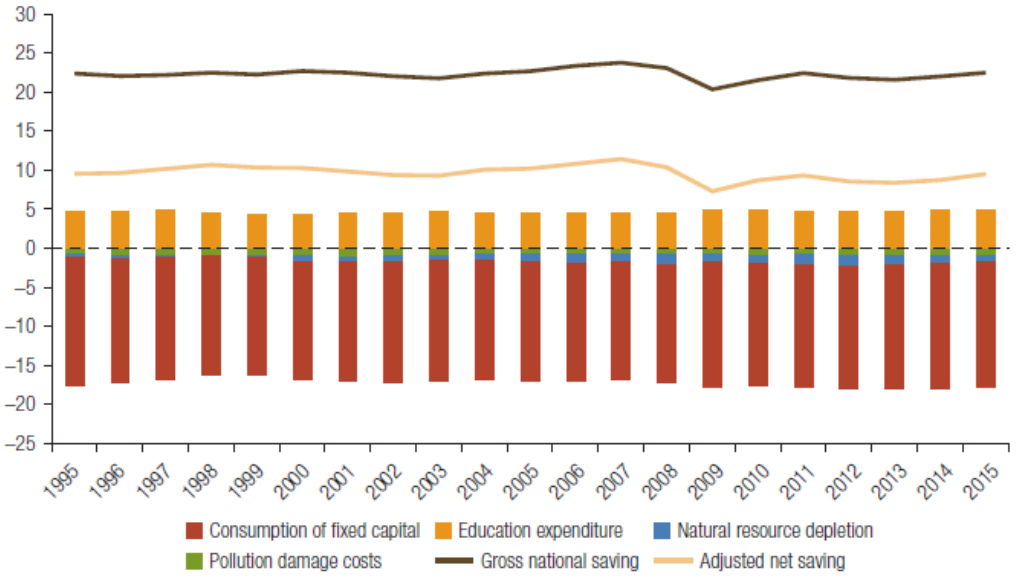


FIGURE 2B.5 Adjusted Net Saving for Europe and Central Asia, 1995–2015

percentage of gross national income



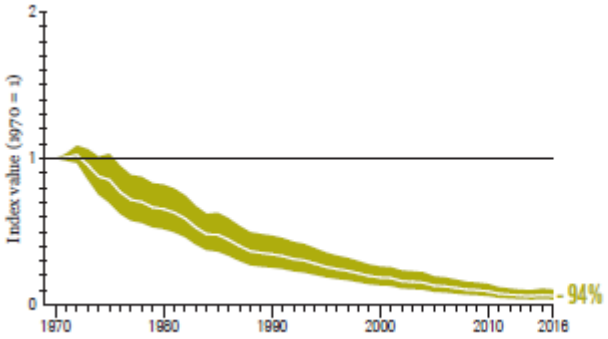
Changing wealth of nations

Source: World Bank 2018 *Changing Wealth of Nations*

https://openknowledge.worldbank.org/bitstream/handle/10986/29001/9781464810466.pdf?sequence=4&isAllowed=y

Living Planet Index

Source: ZSL 2020 Living Planet Report,
https://www.zsl.org/sites/default/files/LPR%202020%20Full%20report.pdf



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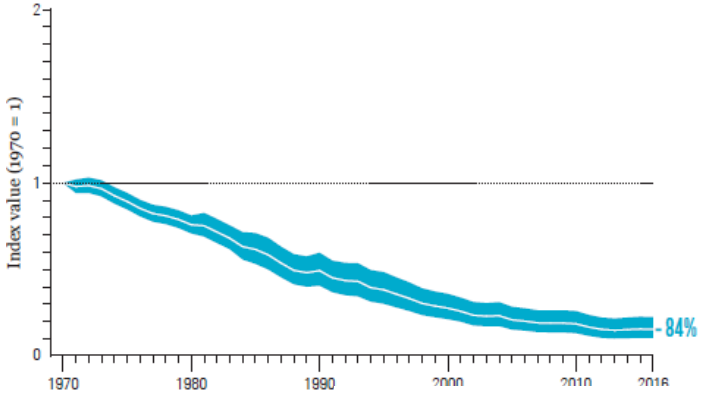


Figure 1: The global Living Planet Index: 1970 to 2016
Average abundance of 20,811 populations representing 4,392 species monitored across the globe declined by 68%. The white line shows the index values and the shaded areas represent the statistical certainty surrounding the trend (range: -73% to -62%). Source - WWF/ZSL (2020)[107].

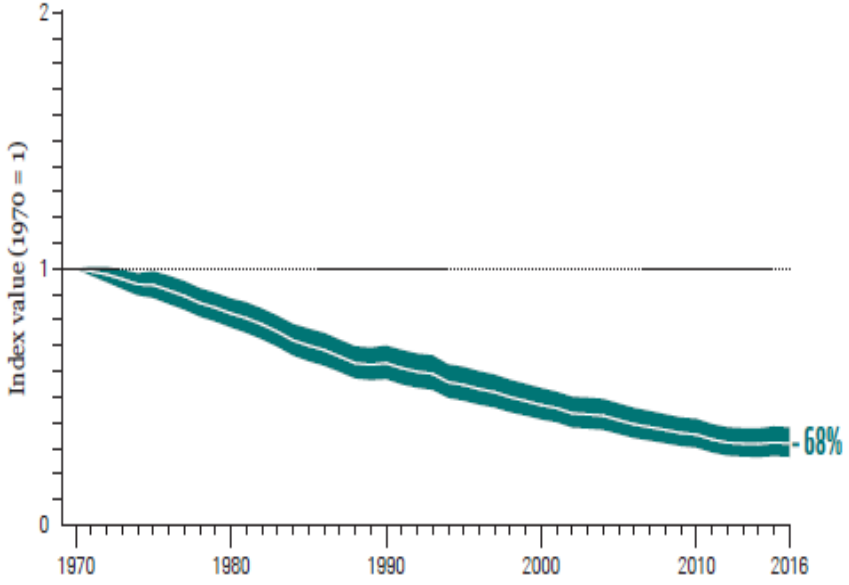


Figure 6: The Freshwater Living Planet Index: 1970 to 2016
The average abundance of 3,741 freshwater populations, representing 944 species, monitored across the globe declined by 84% on average. The white line shows the index values and the shaded areas represent the statistical certainty surrounding the trend (range: -89% to -77%)[107].

Key

Global Living Planet Index
Confidence limits

Key

Freshwater Living Planet Index
Confidence limits

Two worldviews (2)

Strong sustainability

- Substitutability between different forms of 'capital' is limited.
- For some forms of capital (e.g. 'critical natural capital') there is no substitutability, i.e. no other forms of capital can produce the same goods or services
- Motion 62, Principle 3, from the IUCN congress in Marseille : "*Application of the concept of natural capital through any given natural capital approach must at the very least maintain, but preferably enhance, the condition of natural capital.* ***This implies that natural capital approaches should not lead to the substitution of natural capital with other types of capital"*** (https://www.iucncongress2020.org/fr/motion/062)

The solution

- Accept that 'strong sustainability' provides a better description of the world than 'weak sustainability'
- Recognise the validity of the concepts in the scientific literature of 'planetary boundaries', 'safe operating space' and 'environmental sustainability standard'
- Use science-based reference points to define this 'safe operating space' or 'environmental sustainability standards'
- The Inclusive Wealth Report itself recognises: "If one could identify and measure critical capital, and monitor the levels and growth of that capital, it might be possible to develop a sustainability index of critical capital, but it is unlikely a market value of the capital would enter GDP measures anytime soon." (*Inclusive Wealth Report,* p.42)
- **A scientifically robust measurement methodology now exists to do this: ESGAP**

Methodology of a strong sustainability approach

- Identify the important ways that the natural environment and its resources contribute to human welfare: 'environmental functions'
- Define indicators based on scientific environmental standards that show whether these functions are being delivered in a sustainable way
- Express these indicators at the national level in a way that is accessible for policy makers
- For the ESGAP approach: aggregate these indicators into two indexes that show the current 'sustainability gap' and the trend towards closing it

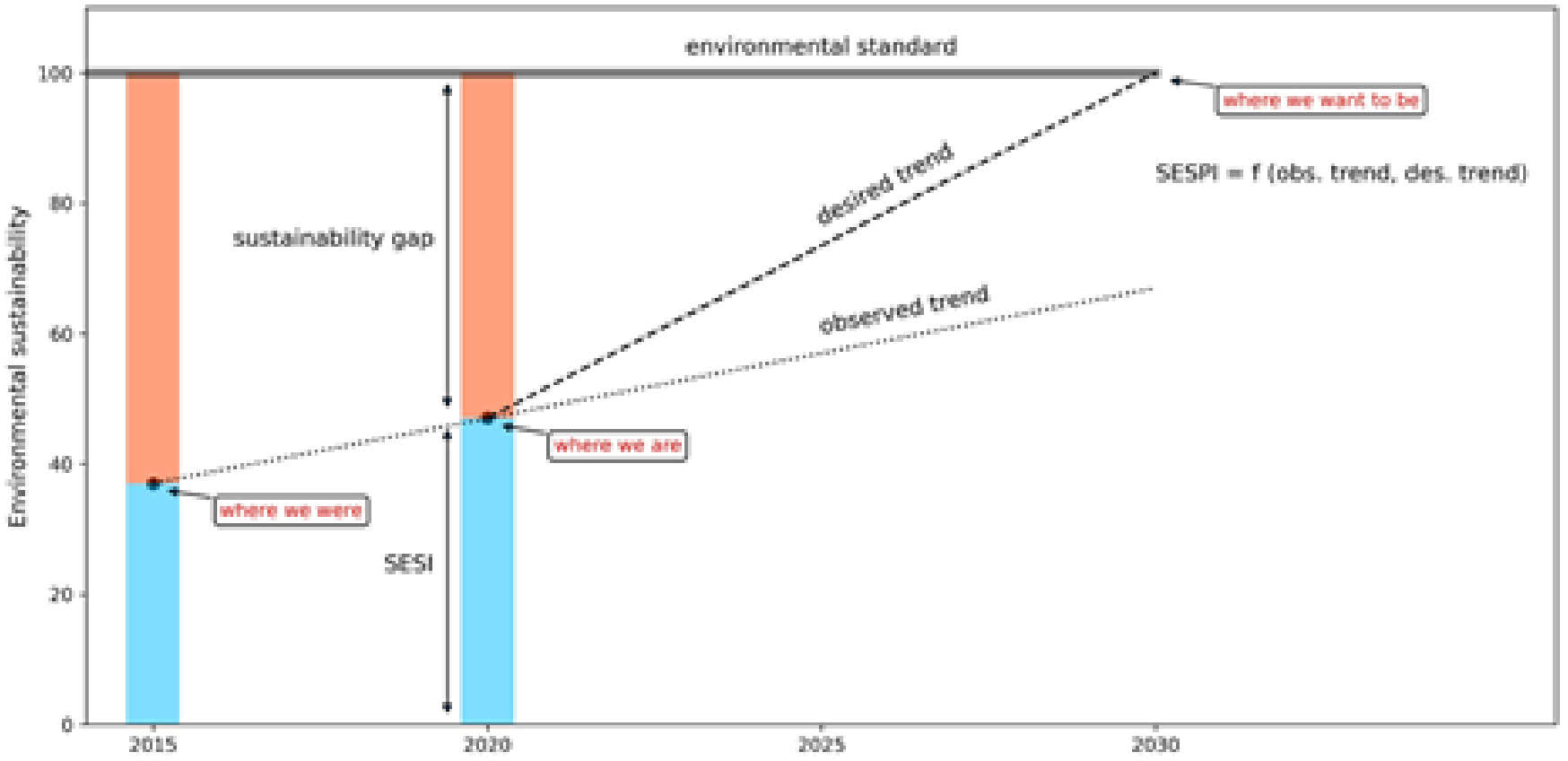
General features of the ESGAP framework

- Structured around **four broad functions**:
  - Source: provision of biotic and abiotic resources
  - Sink: assimilation of waste
  - Life Support: maintenance of ecosystem health and function
  - Human Health and Welfare: other functions related to human health or amenity.
- Structured around **seven broad sustainability principles**:
  - Source: renew renewable resources, use non-renewable resources prudently
  - Sink: prevent the disruption of global processes, respect critical loads/levels for ecosystems
  - Life Support: maintain biodiversity and ecosystem health
  - Human Health and Welfare: respects health standards, maintain landscape values and amenity
- For 28 European countries, 21 **indicators**, each with its own environmental standard.

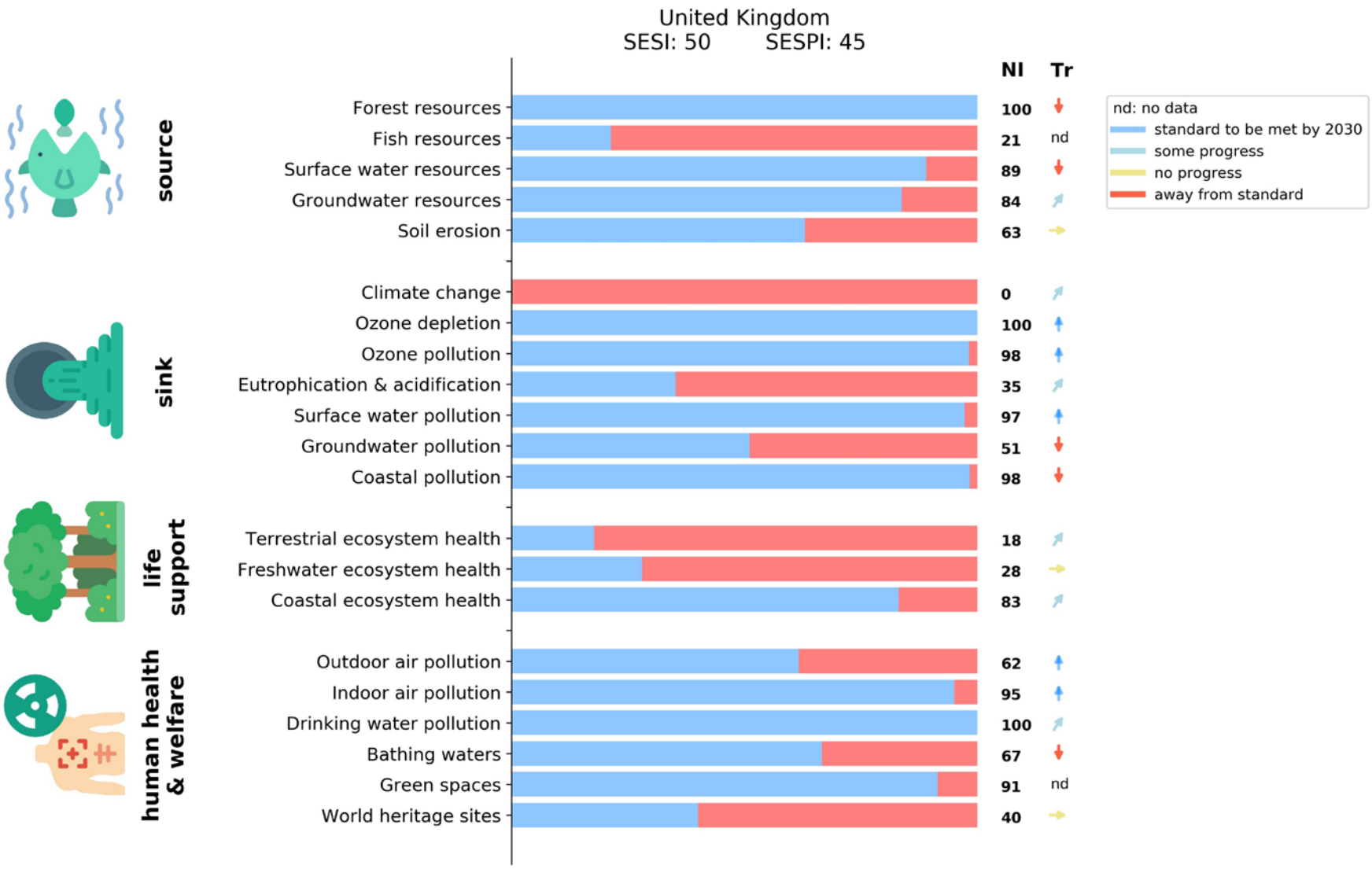
Framework structure

The Strong Environmental Sustainability Progress Index (SESPI)

Usubiaga-Liano, A. and Ekins, P. 2022 'Are we on the right path? Measuring progress towards environmental sustainability in European countries', *Sustainability Science*, doi.org/10.1007/s11625-022-01167-2



Country results



Conclusions

- The systematic trade-off of natural capital (resources and the environment) for economic gain has brought about the crises of climate, nature and pollution
- The weak sustainability mind-set which has justified this trade-off must be abandoned for a strong sustainability approach
- Strong sustainability requires the use of science-based environmental standards to define a 'safe operating space' for human activities, where this ensures the maintenance of important environmental functions
- A dashboard of indicators of strong sustainability needs to be defined at the national level as this is the level at which most environmental policy is set
- These indicators must be able to be aggregated into a single figure to give policy makers and the public an immediate view of how far a country is from the safe operating space, and whether it is moving towards it or not. simple
- The ESGAP approach fulfils these strong sustainability criteria and the Strong Environmental Sustainability Index (SESI) and Strong Environmental Sustainability Progress Index (SESPI) are the indices which give policy makers the summary information that they need

Thank you

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Showcasing the potential of the ESGAP framework to promote strong sustainability thinking in South Africa

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23/10/2025

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2023 - 2027

General context

Conceptual framework

Ecological Economics
Volume 44, Issues 2–3, March 2003, Pages 165-185

ANALYSIS

A framework for the practical application of the concepts of critical natural capital and strong sustainability ☆

Paul Ekins [a], Sandrine Simon [b], Lisa Deutsch [c], Carl Folke [c, d], Rudolf De Groot [e, f]

Ecological Economics
Volume 44, Issues 2–3, March 2003, Pages 277-292

Identifying critical natural capital: Conclusions about critical natural capital

Paul Ekins

ORIGINAL RESEARCH article
Front. Environ. Sci., 22 November 2021
Sec. Environmental Economics and Management

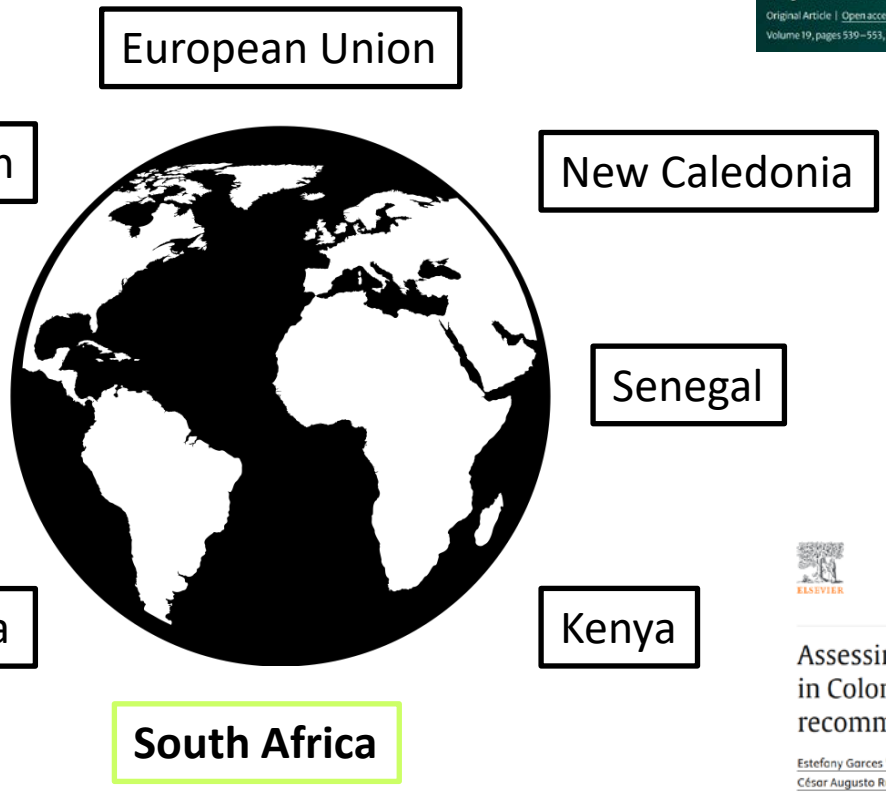
Time for Science-Based National Targets for Environmental Sustainability: An Assessment of Existing Metrics and the ESGAP Framework

Arkaitz Usubiaga-Liaño* Paul Ekins

Ecological Economics
Volume 221, July 2024, 108192

Methodological choices for reflecting strong sustainability in composite indices

Arkaitz Usubiaga-Liaño [a], Paul Ekins [b]



Case studies

Home › Sustainability Science › Article

Monitoring environmental sustainability in Japan: an ESGAP assessment

Original Article | Open access | Published: 10 January 2024
Volume 19, pages 539–553, (2024) Cite this article

Ecological Indicators
Volume 132, December 2021, 108281

Original Articles

Monitoring the environmental sustainability of countries through the strong environmental sustainability index

Arkaitz Usubiaga-Liaño, Paul Ekins

Home › Sustainability Science › Article

Are we on the right path? Measuring progress towards environmental sustainability in European countries

Original Article | Published: 30 June 2022
Volume 18, pages 755–770, (2023) Cite this article

Environmental Science & Policy
Volume 146, August 2023, Pages 113-122

Measuring and managing for environmental sustainability. An application of the Environmental Sustainability Gap (ESGAP) framework in New Caledonia

Adrien Comte [a b c], Clément Surun [b], Harold Levrel [b c]

Environmental and Sustainability Indicators
Volume 27, September 2025, 100812

Assessing environmental sustainability in Colombia: Metrics and policy recommendations

Estefany Garces [a], Carlos J. Franco [a], Arkaitz Usubiaga-Liaño [b], César Augusto Ruiz-Agudelo [c], Alison Fairbrass [d]

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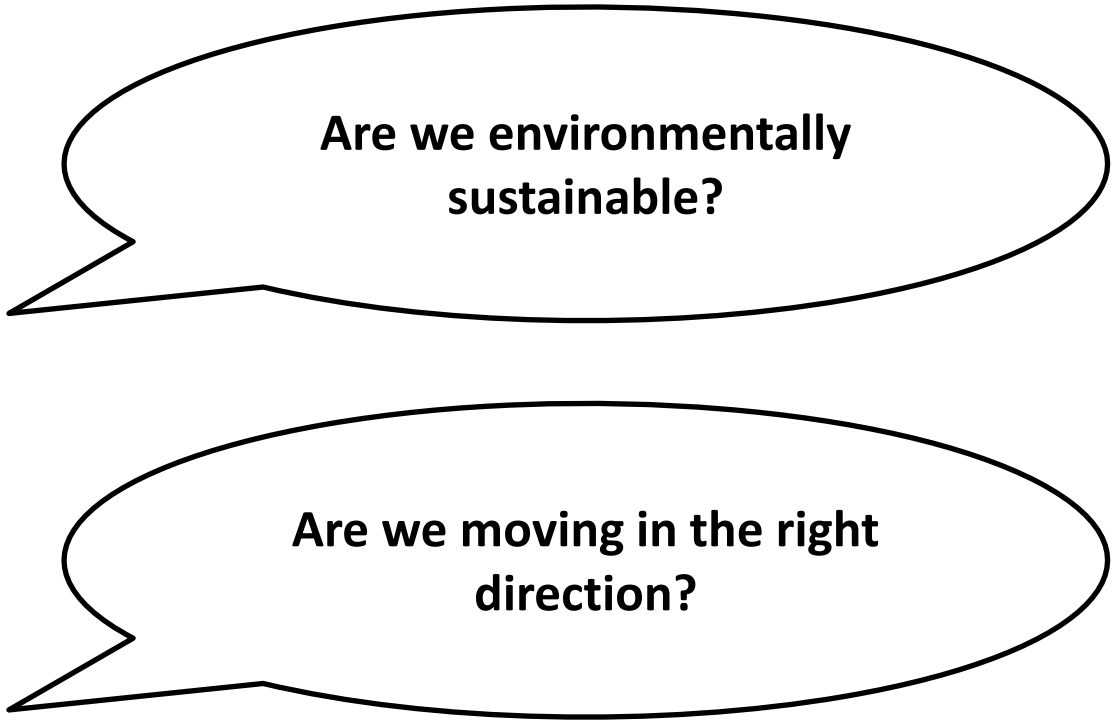
ESGAP metrics

- **Strong Environmental Sustainability Index (SESI)**: It provides a snapshot of a country's absolute performance against **environmental standards** that are linked to different environmental and resource areas.

- **Strong Environmental Sustainability Progress Index (SESPI)**: It compares observed trends against sustainable trends across different environmental and resource areas.

(*) Science-based environmental standards reflect environmental sustainability conditions. They are often more stringent than policy targets.



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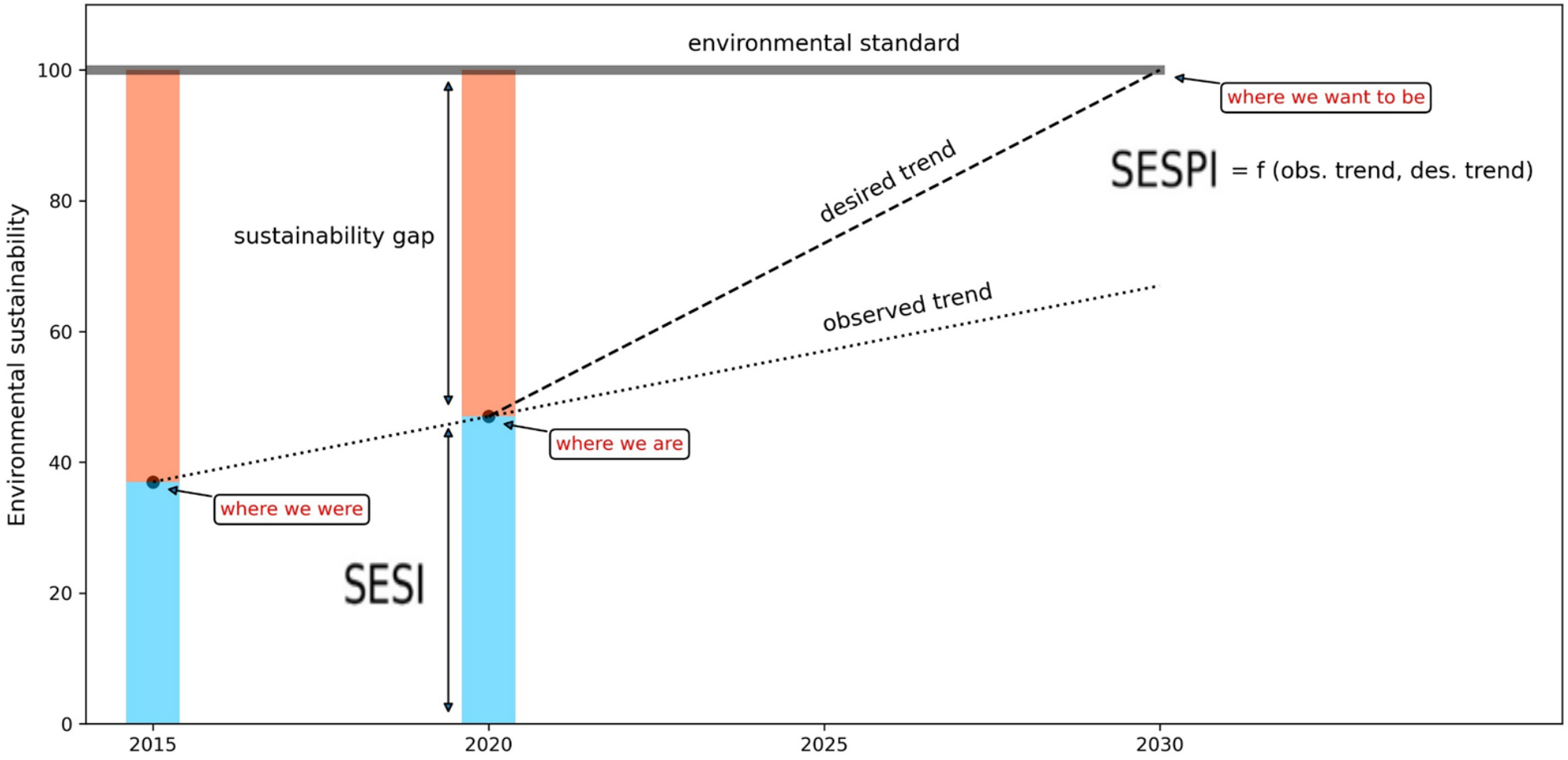
ESGAP metrics



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Indicator selection

- Guided by the European case study
    - Conceptual relevance
        - indicators linked to the functions of natural capital
        - and existence of a science-based environmental standard
    - Methodological soundness and data quality
- Overall, 19 indicators. Most data for 2021 or later. A few more could have been added in the sink function, but data was not easily retrievable.
    - Four for source function
    - Three for the sink function
    - Ten for the life support function
    - Four for the human health and other welfare function

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Indicator selection

Function	Sustainability principle	Environmental topic	Indicator
Source	Renew renewable resources	Biomass resources	Fish stocks considered 'not of concern'
		Water resources	Freshwater withdrawal as a proportion of available freshwater resources
			Groundwaters in normal status or better
	Use non-renewable resources prudently	Soil resources	Area with tolerable soil erosion
Sink	Prevent the disruption of Earth System processes	Climate change	Per capita CO2 emissions
		Ozone layer	Consumption of ozone depleting substances
	Respect critical loads for ecosystems	Ecosystem critical loads	Dams in oligotrophic status
Life Support	Maintain ecosystem health	Terrestrial ecosystems	Terrestrial ecosystems not threatened
		Freshwater ecosystems	River ecosystems not threatened
			Inland wetlands not threatened
		Marine & Coastal Ecosystems	Marine ecosystems not threatened
			Coastal ecosystems not threatened
			Estuarine ecosystems not threatened
	Maintain biodiversity	Terrestrial ecosystems	Species in terrestrial ecosystems not threatened
		Freshwater ecosystems	Species in freshwater ecosystems not threatened
		Marine & Coastal Ecosystems	Species in marine ecosystems not threatened
			Species in estuarine ecosystems not threatened
Human health and welfare	Respect standards for human health	Air pollution	Population exposed to safe PM2.5 levels
			Population using clean fuels and technology for cooking
		Drinking water pollution	Water supply systems with (almost) full compliance with microbiological criteria
	Conserve other welfare	Recreation	Recreational sites that comply with microbiological criteria

SESI computation

Step	Description	Method
Normalisation	Normalisation brings indicators onto a common scale, which renders the variables comparable.	We normalise using science-based standards as reference points (goalpost). $$NI = 100\frac{I - gp_{min}}{gp_{max} - gp_{min}}$$
Weighting	When indicators are aggregated into a composite measure, they can be assigned individual weights. This allows the effect or importance of each indicator to be adjusted according to the concept being measured.	Equal weights in absence of more reliable method to capture implicit importance.
Aggregation	Aggregation combines the values of a set of indicators into a single summary 'composite' or 'aggregate' measure.	Geometric mean to represent the limited substitutability between the functions provided by natural capital.

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SESPI computation

Step	Description	Method
Data treatment	Compares observed trends (lineal between t_0 and t_1) against desired trends (lineal trend needed to reach environmental standards in 2030).	$trend_{obs} = \frac{I_1 - I_0}{t_1 - t_0}$ $trend_{des} = \frac{x_{t_r} - I_1}{t_r - t_1}$ $R_{o-d} = \frac{trend_{obs}}{trend_{des}}$
Normalisation	Normalisation brings indicators onto a common scale, which renders the variables comparable.	$NI = 50 + 50R_{o-d}$ If NI equals 100, the environmental standard will be reached in 2030 or sooner. If NI equals 50, there is no change in the trend. If NI equals 0, the trend is the opposite of the desired trend
Weighting and aggregation	Same as in SESI	Equal weights in absence of more reliable method to capture implicit importance. Geometric mean to represent the limited substitutability between the functions provided by natural capital.

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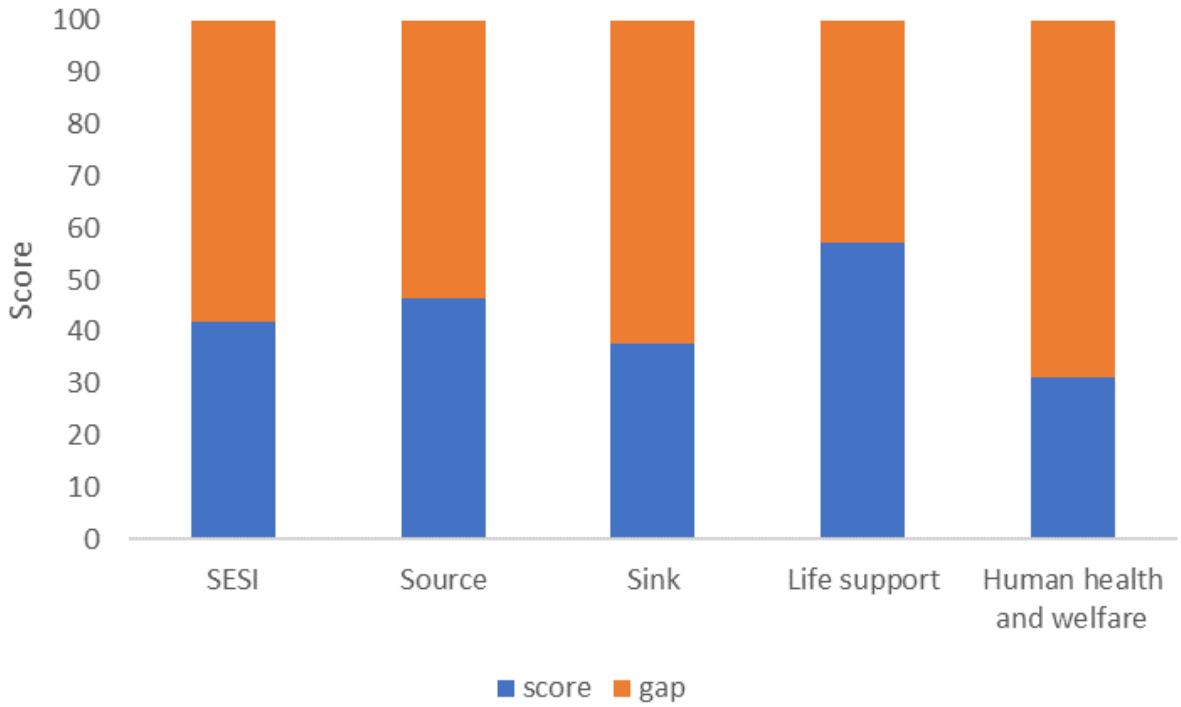
Results

- South Africa obtained a SESI score of 42, which shows that the country is far from meeting environmental sustainability conditions reflected by science-based environmental standards.

- The country performs best in the life support function (score of 57), followed by source (47 points) and sink (38 points).

- At the bottom, the human health and welfare function obtained a score of 31 points.



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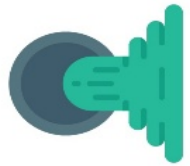
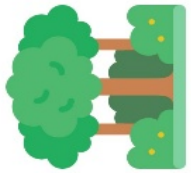
Results

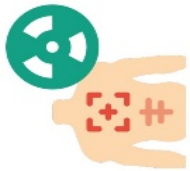
source



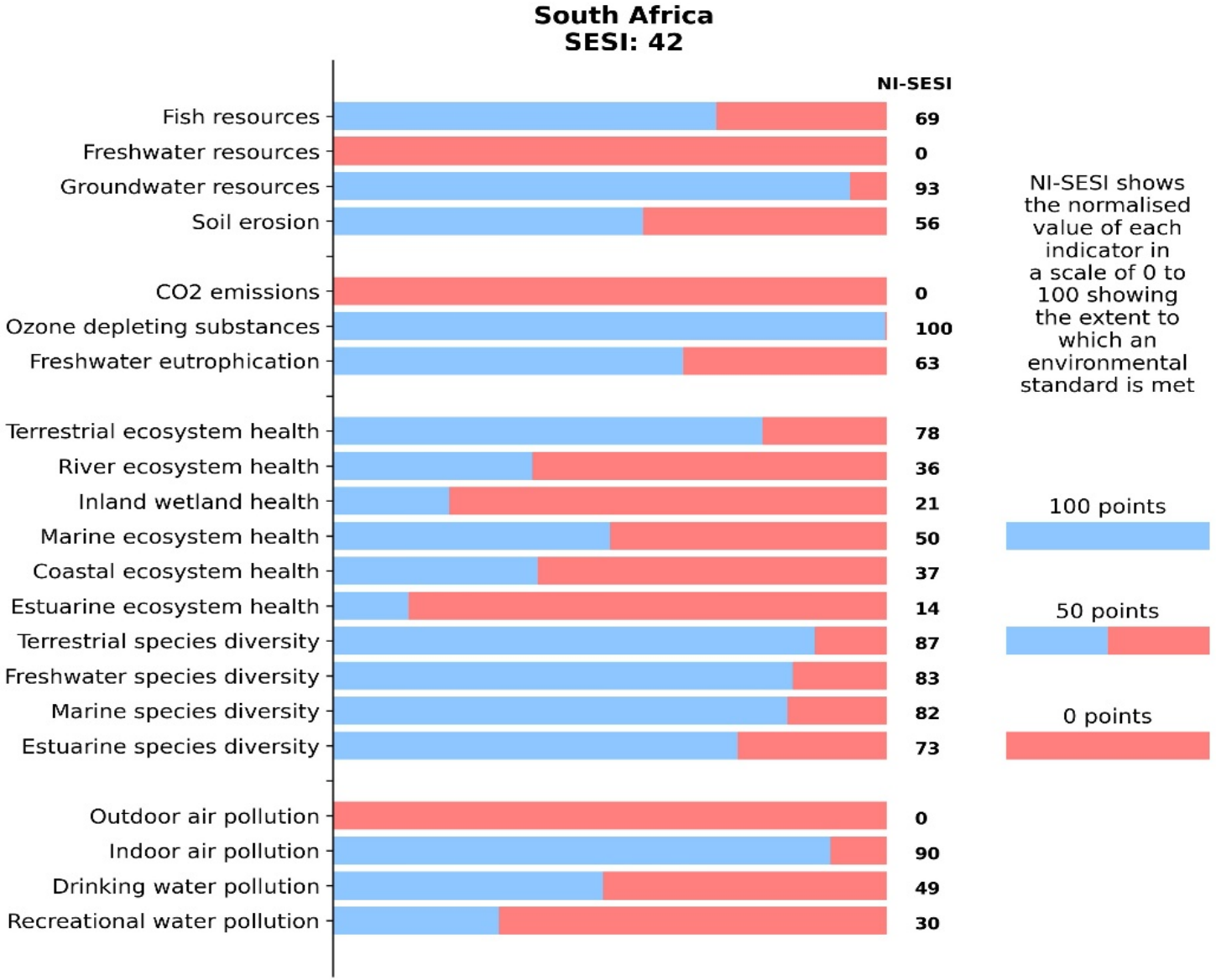
sink



life support



human health & welfare



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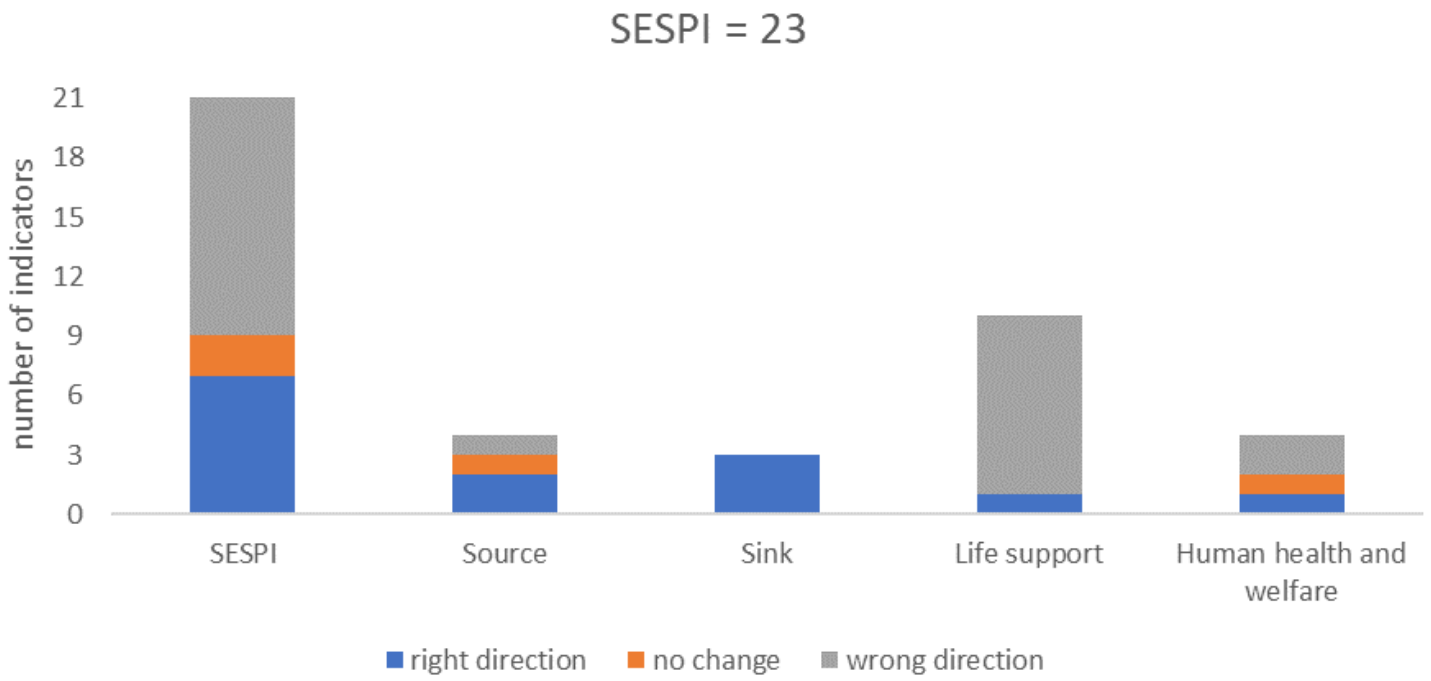
Results

- SESPI also shows that the overall situation is not improving.
- With a score of 23 points, 12 of the 19 indicators (63%) describe negative trends.
- Additionally, two indicators (10%) show no signs of improvement, while seven indicators (27%) are moving in the right direction.



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Discussion

- The ESGAP framework provides a robust conceptual basis for environmental sustainability assessment at the national level.

- The main novelty of SESI and SESPI is the use of science-based environmental standards to measure the absolute environmental sustainability performance of countries or progress towards it.

- SESI and SESPI can produce relevant messages at two levels.
  - They can summarise complex or multidimensional issues for non-technical audiences.
  - The dashboard of indicators provides more detailed messages around the areas that require policy attention.

- South Africa compiles a wealth of information related to natural capital and its functions as reported in outlets such as the South African Environment Report, the National Water Assessment, the National Biodiversity Assessment and the State of Air Report.

- ESGAP could be trialled at the South African Environment Report in which every year different headline indicators are selected to develop key messages.

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Policy recommendations

- Mainstream strong sustainability metrics into national climate commitments
- Develop strong sustainability standards for public and private investment
- Align national policy targets with science-based environmental standards
- Embed strong sustainability thinking in municipal development plans

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Conclusions

- This work showcases the potential of the ESGAP framework to embed strong sustainability thinking in national policymaking.

- SESI & SESPI provide easy-to-understand messages around environmental sustainability. The underlying indicators point towards areas that need improvement.

- The set of science-based environmental standards can be used to define a vision of how a country's environment should be in the future.

- There is clear potential to bring strong sustainability into South African policies and indicator reporting initiatives.

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Thank you

Muchas gracias

Eskerrik asko

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