
Biodiversity Finance: A Call for Research into Financing Nature

Andrew Karolyi | June 26, 2022

Keynote Presentation to 2022 Western Finance Association Meetings, Portland, OR



Cornell
SC Johnson College of Business

Belize's \$364m Blue Bond Issuance in 2021



Nature And People Positive Solutions: The Nature Conservancy In Belize

Forbes



EDITOR'S CHOICE AWARD

The Nature Conservancy

The Editor's Choice Award exists to enable IFLR to recognise outstanding initiatives or projects that do not fall into our predefined categories. In recognition of its extraordinary effort on Belize's blue bond, this year's winner is The Nature Conservancy. The Conservancy's tireless work was vital in closing one of 2021's most impactful transactions. Deal parties described The Nature Conservancy team as the engine of the deal. They were consistently impressed with the team's ability to manage both the legal and business challenges of the bond, as well as to bring together a huge number of different stakeholders.

Biodiversity Loss as a Severe Global Risk

“Identify the most severe risks on a global scale over the next 10 years”

■ Economic ■ Environmental ■ Geopolitical ■ Societal ■ Technological

1st Climate action failure

2nd Extreme weather

3rd Biodiversity loss

4th Social cohesion erosion

5th Livelihood crises

6th Infectious diseases

7th Human environmental damage

8th Natural resource crises

9th Debt crises

10th Geoeconomic confrontation

Source: World Economic Forum Global Risks Perception Survey 2021-2022



A Biodiversity Finance Imperative

- **What exactly is “biodiversity”?**

A formal definition: “Biodiversity - the contraction of the terms “biological” and “diversity” - describes the diversity of life on Earth. It includes all organisms, species, and populations; the genetic variation among these; and their complex assemblages of communities and ecosystems.” (*UN Environment Programme*)

- **What is biodiversity loss risk?**

More than half of world’s GDP (~\$40 trillion) is “moderately or highly dependent” on nature & its services (UNEP, World Economic Forum)

- Mammals, birds, fish, reptile and amphibian populations declined by 60% in last four decades
- UN Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) argues humans are damaging nature more rapidly than it can renew
- A 2020 joint report of the Paulson Institute, The Nature Conservancy, Cornell’s Atkinson Center estimates financial flows into global biodiversity conservation in 2019 of \$124b - \$143b falls well short of \$722b - \$867b needed per year to halt decline in biodiversity

A Biodiversity Finance Imperative

Global Assessment Report on
Biodiversity and Ecosystem
Services

The Economics
of Biodiversity:
The Dasgupta
Review



The State of Finance for Nature in the G20

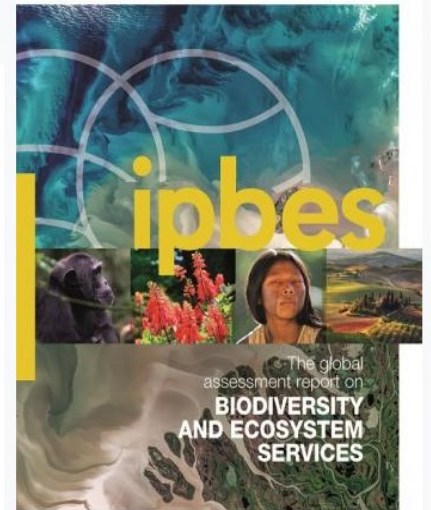
Leading by example to close
the investment gap

UN
environment
programme

50
1972-2022


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LAND DEGRADATION



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A (hopefully) useful start!

Biodiversity Finance: A Call for Research into Financing Nature

24 Pages • Posted:

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Cornell University - SC Johnson College of Business

[John Tobin-de la Puente](#)

Cornell University - SC Johnson College of Business

Date Written: June 21, 2022

Available at

SSRN: <https://ssrn.com/abstract=4142482>

Abstract

Biodiversity conservation will eclipse climate change risk mitigation and adaptation as the next grand challenge for sustainable finance. Closing the financial gap between what is currently spent and what is needed to be spent over the next ten years to mobilize private investment to maintain ecosystem integrity and biodiversity, and the services they provide, is estimated to exceed hundreds of billions per year. Yet, there are no studies in the top tier journals in Finance that have framed the risks related to biodiversity loss, how those risks might be priced, or how the private financing flows need to be intermediated. We lay out one framework and outline important open research questions for financial economists to pursue.

Keywords: Biodiversity, finance, climate change, investments, corporate financial management

JEL Classification: E50, G40, G11

A critical definition and tracing roots

The Biological Diversity Crisis

Despite unprecedented extinction rates, the extent of biological diversity remains unmeasured

Edward O. Wilson

Certain measurements are crucial to our ordinary understanding of the universe. What, for example, is the mean diameter of Earth? 12,742 km. How many stars are there in the Milky Way? 10^{11} . How many genes in a small virus particle? 10 (in ϕ X174 phage). What is the mass of an electron? 9.1×10^{-28} grams. How many species of organisms are there on Earth? We don't know, not even to the nearest order of magnitude.

Of course, the number of *described* species is so impressive that it might appear complete. The corollary would be that systematics is an old-fashioned science concerned mostly with routine tasks. In fact, about 1.7 million species have been formally named since Linnaeus inaugurated the binomial system in 1762. Some

**The pool of diversity
is a challenge to
basic science and
a vast reservoir of
genetic information**

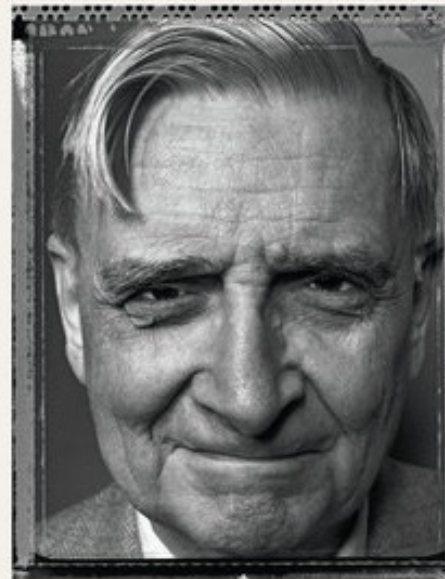
Earth, and its true magnitude is still a mystery. In 1964 the British ecologist C. B. Williams, employing a combination of intensive local sampling and mathematical extrapolation, projected the number of insect species at three million (Williams 1964). During the next 20 years, systematists described several new complex faunas in relatively unexplored habitats such as the floor of the deep sea. Then the

come these difficulties, a projectile with a line attached is first shot over one of the upper branches. A canister containing an insecticide and swift-acting knockdown agent is then hauled up into the canopy, and the contents are released as a fog by radio command. As the insects and other arthropods fall out of the trees (the chemicals do not harm vertebrates), they are collected in sheets laid on the ground. The numbers of species proved to be far greater than previously suspected because of unusually restricted geographical ranges and high levels of specialization on different parts of the trees. Erwin extrapolated a possible total of 30 million insect species, mostly confined to the rainforest canopy.

If astronomers were to discover a

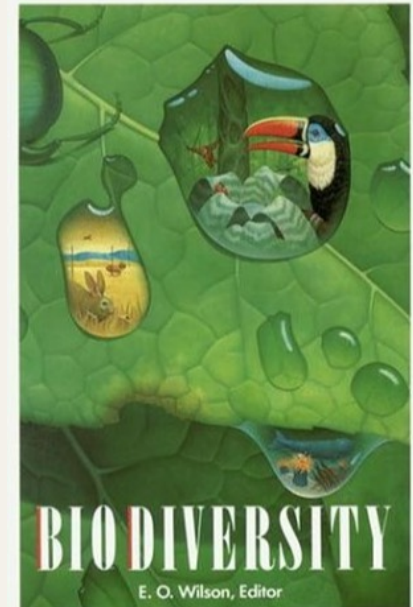
SCIENTIST

E. O. WILSON: A LIFE IN NATURE



RICHARD RHODES

WINNER OF THE PULITZER PRIZE



The Economic Science of Biodiversity

ON DIVERSITY*

MARTIN L. WEITZMAN

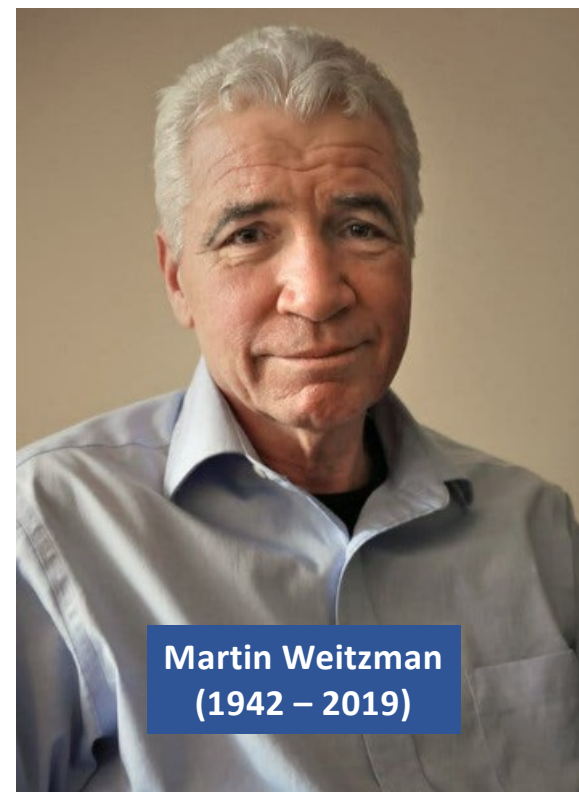
An oft-repeated goal in many contexts is the “preservation of diversity.” But what is the diversity function to be optimized? This paper shows how a reasonable measure of the “value of diversity” of a collection of objects can be recursively generated from more fundamental information about the dissimilarity-distance between any pair of objects in the set. The diversity function is shown to satisfy a basic dynamic programming equation, which in a well-defined sense generates an optimal classification scheme. A surprisingly rich theory of diversity emerges, having ramifications for several disciplines. Implications and applications are discussed.



WHAT TO PRESERVE? AN APPLICATION OF DIVERSITY THEORY TO CRANE CONSERVATION*

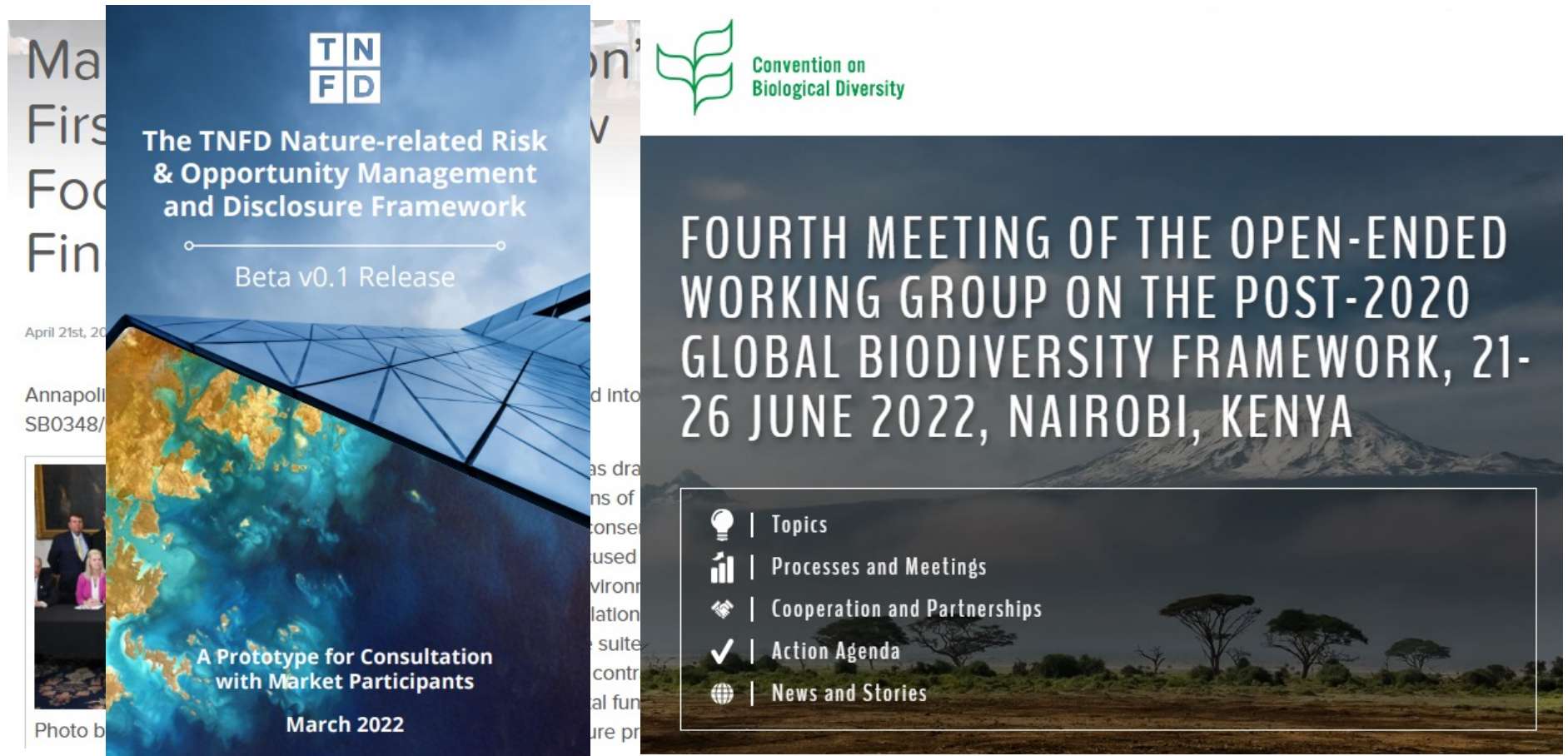
MARTIN L. WEITZMAN

This paper attempts to demonstrate how “diversity theory” can be applied to the analysis of real-world conservation policies. The specific example chosen to serve as a paradigm concerns preservation priorities among the fifteen species of cranes living wild throughout the world. The example is sufficiently actual to show how diversity theory can be used operationally to frame certain critical conservation questions and to guide us toward answers by providing informative quantitative indicators of what to protect. At the same time the cranes example is rich enough that it illustrates nicely some broad general principles about the economics of diversity preservation.



Martin Weitzman
(1942 – 2019)

Regulatory change coming and fast



TNFD

The TNFD Nature-related Risk & Opportunity Management and Disclosure Framework

Beta v0.1 Release

Convention on Biological Diversity

FOURTH MEETING OF THE OPEN-ENDED WORKING GROUP ON THE POST-2020 GLOBAL BIODIVERSITY FRAMEWORK, 21-26 JUNE 2022, NAIROBI, KENYA

- Topics
- Processes and Meetings
- Cooperation and Partnerships
- Action Agenda
- News and Stories

Blue Bonds, Rhino Bonds, Carbon Offsets...Oh My!

World Bank Issues The World's First Wildlife Conservation Bond

The World Bank sells its first 'Rhino' bond to help South Africa's conservation efforts and support local communities



by **Amber van Unen** — March 29, 2022 in **Environment, Impact**



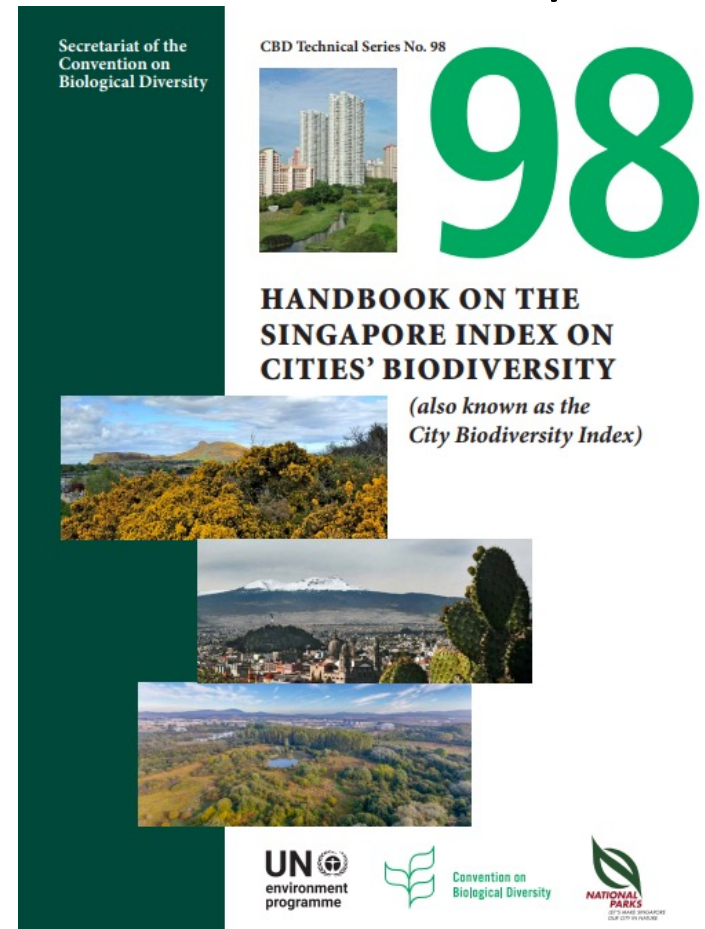
Helping you reach Net Zero

The Climate Emergency and biodiversity crisis are two of this century's greatest challenges. In response, Scotland has committed to reach Net Zero by 2045. Meeting this target will require efforts from individuals, organisations and businesses of every

What are some open research questions?

- No concerted efforts to date to compile **database of biodiversity-linked deals**, how priced, who owns, post-issuance biodiversity-linked bond performance, muni contracts and biodiversity-linked covenants (Flammer, 2021, Posenau, 2022)
 - Bloomberg New Energy Finance, Climate Bonds Initiative examples
- **Measurement is key.** Unlike climate finance with MTCO₂e GHG emissions, there is no single science-based, agreed-upon biodiversity loss policy goal (Boerg, Koelbel & Rigobon, 2022, Pastor et al., 2022)
 - Consider Biodiversity Land Use score within MSCI EVA Environmental Pillar
- To what extent are operational performance and corporate investment decisions influenced by **exposure to adverse biodiversity impacts**? Which sectors? Geospatial identification? (Addoum, Ortiz-Bobea, Ng, 2020)
- **Do investors care about biodiversity risk exposures?** Negative screening? Attention to systematic biodiversity loss? Real corporate actions? (Choi, Gao, Jiang, 2020; Krueger, Sautner, Starks, 2020; Bolton and Kacperczyk, 2021; Appel and Akey, 2020; Naarayaan et al. 2020)

Lots and Lots of Data and Cool Biodiversity Indexes



THANK YOU



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Belize's \$364m Blue Bond Issuance in 2021



Snorkeling and diving tour boats close to the barrier reef of the Lighthouse Reef Atoll, Belize, Caribbean Sea. (Photo by: Andre Seale/VW PICS/Universal Images Group via Getty Images) [-] VW PICS/UNIVERSAL IMAGES GROUP VIA GETTY IMAGES



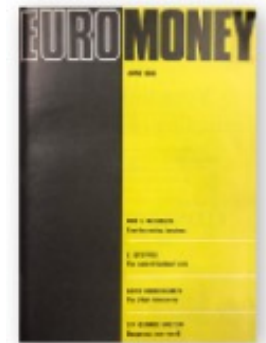
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Environmental Finance's Bond Awards 2022

Nature And People Positive Solutions: The Nature Conservancy In Belize

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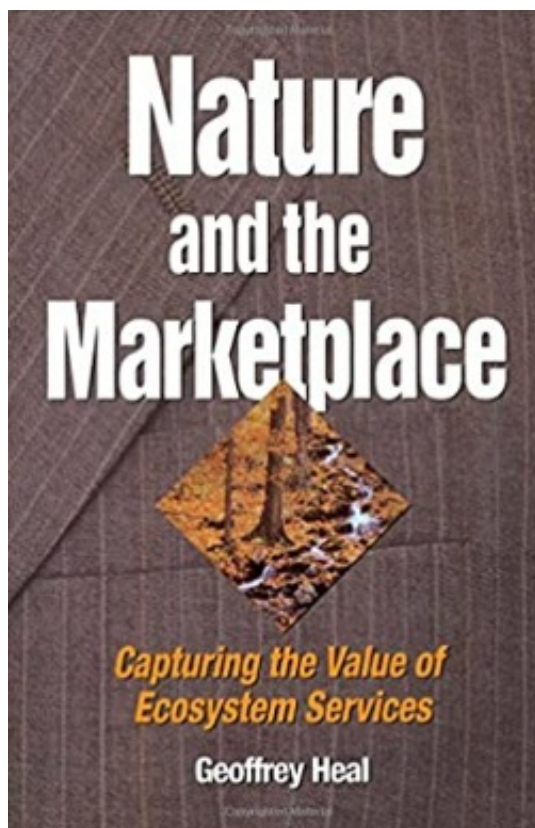


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Valuing Nature and the Marketplace



Econometrica, Vol. 70, No. 3 (May, 2002), 1155–1198

A THEORY OF DIVERSITY

BY KLAUS NEHRING AND CLEMENS PUPPE¹

How can diversity be measured? What does it mean to value biodiversity? Can we assist Noah in constructing his preferences? To address these questions, we propose a multi-attribute approach under which the diversity of a set of species is the sum of the values of all attributes possessed by some species in the set. We develop the basic intuitions and requirements for a theory of diversity and show that the multi-attribute approach satisfies them in a flexible yet tractable manner.

A natural starting point is to think of the diversity of a set as an aggregate of the pairwise dissimilarities between its elements. The multi-attribute framework allows one to make this program formally precise only if the family of relevant attributes has a unique functional form aggregating spanning tree. Examples are taxonomic qualities. In multi-dimensional space, this approach is insufficient to determine the behavior of diversity differs from



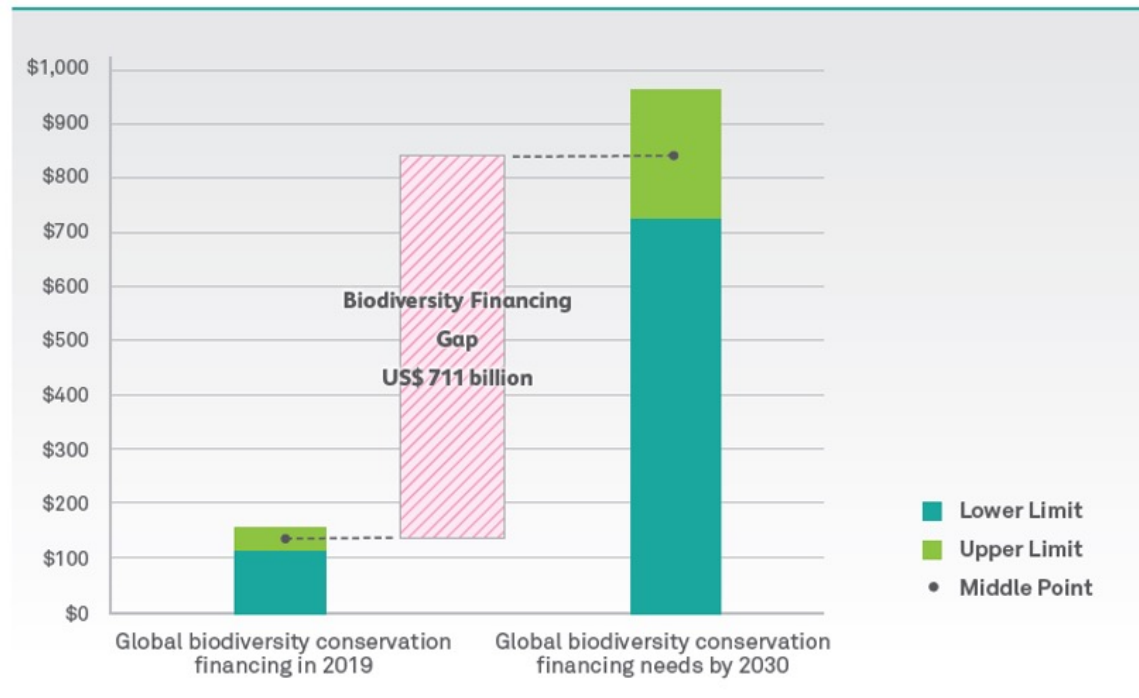
Valuing Biodiversity from an Economic Perspective: A Unified Economic, Ecological, and Genetic Approach

By WILLIAM A. BROCK AND ANASTASIOS XEPAPADEAS*

We develop a conceptual framework for valuing biodiversity from an economic perspective. We argue for a dynamic economic welfare measure of biodiversity that complements the literature on benefit-cost approaches and genetic distance/phylogenetic tree approaches. Using a unified model of optimal economic management of an ecosystem under ecological and genetic constraints, we identify gains from management policies leading to a more diverse system, using the Bellman state valuation function of the problem. We show that a more diverse system could attain a higher value although the genetic distance of the species in the more diverse system could be almost zero. (JEL Q2)



Estimating Biodiversity Financing Gap



Source: *Financing Nature: Closing the Global Biodiversity Financing Gap*, by Deutz, A., Heal, G., Niu, R., Swanson, E., Townshend, T., Zhu, L., Delmar, A., Meghji, A., Sethi, S., and Tobin-de la Puente, J., 2020, The Paulson Institute, The Nature Conservancy, and the Cornell Atkinson Center for Sustainability.