Executive Summary

The *Profitable Biodiversity* Consultancy: Delivering Technology to Build Profitable Biodiversity-Conserving Offerings

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Figure 1: The Bengal tiger has been poached to near extinction for its bones and genitals.

Overview

Earth is in the middle of an *extinction crisis* (Torres-Romero et al. 2024, Garber et al. 2024). It is now clear that the present way that biodiversity conservation projects are funded

has failed to conserve biodiversity. Government conservation programs have nowhere near enough resources nor sufficient political sustainability to stem the rapid loss of biodiversity everywhere. And the charity-based business model that conservation-focused NGOs have adopted is not able to draw in enough resources to take up the slack left by governments.

Habitat loss is often pointed to as the principal driver of global biodiversity loss (Hanski 2011). But recently, one study could find no statistical difference between loss of habitat and *direct exploitation*, i.e., intentional harvesting of wildlife either legally or illegally (Jaureguiberry et al. 2022). The illegal harvesting and trading of wildlife is often referred to as *wildlife trafficking*.

A large, untapped market niche

The literature suggests that there is a large number of potential *biodiversity-concerned customers* (Petro 2022, Haas 2024) and that further, these customers would rather buy a product or service (hereafter, *offering*) that is associated with a project that is directly contributing to biodiversity conservation rather than simply donating to a biodiversity-focused charity (Elfenbein and McManus 2010). Here, a *biodiversity offering* is one whose purchase funds a direct and specific expenditure on some aspect of biodiversity conservation. Such funding accrues through a *biodiversity premium* that the firm adds onto the offering's purchase price.

Tying biodiversity conservation to the thousands of products and services offered across the globe taps the spending power of many of the planet's consumers. This knot also directs towards biodiversity conservation, the massive resources that firms devote to their marketing campaigns and supply chain operations.

Profits first

To be sustainable and hence effective, biodiversity offerings need to be designed to be profitable and need to be operated as such. To these ends, this consultancy leverages technology to find pricing strategies (Du and Xiao 2019) that result in a firm experiencing a positive revenue stream from its biodiversity offerings. These strategies would include the added biodiversity premium.

Conservation-focused nongovernmental organizations (NGOs) can benefit from this consultancy's services by (a) marketing a tangible biodiversity offering that is useful to the customer by itself; (b) creating a specific and unique biodiversity project; and (c) setting the profit level goal to zero during all project configuration computations (see **Business Plan: Step 3**, below).

Figure 2: A scruffy cycad. This endangered species predates the dinosaurs.

Maintaining customer loyalty

Operating public-facing *biodiversity dashboards* would give these biodiversity-concerned customers a way to assess what effect their individual purchases have on biodiversity conservation. Such detailed, real-time feedback of how a purchase affects biodiversity would help to address the sense of powerlessness that many biodiversity-concerned customers experience when deciding to purchase an environmentally sustainable offering (Seyfang 2005).

Funding biodiversity conservation with purchases made in developed countries presents an additional challenge in that most endangered species are in developing countries where their biggest threat to survival is direct exploitation. Feedback provided by a biodiversity dashboard can bridge the gap between biodiversity-concerned customers in developed countries wanting to see verified progress on the curbing of such exploitation in distant, developing countries.

Business Plan (Haas 2022)

Step 1: A firm identifies a species they want to save from extinction, called here the *endangered species*.

Step 2: They launch a biodiversity offering that is attached to a *biodiversity project*. They market this offering to biodiversity-concerned consumers (Figure 3). Call a biodiversity

offering and its attached biodiversity project, an *offering-project pair*.

Step 3: This attached project is configured by first modeling the political-ecological system that hosts the endangered species, and then via such business modeling, identifies a project configuration that is maximally profitable, and has the highest chance of being politically feasible while maximally conserving the endangered species. Call this selected project configuration, the Most Practical Ecosystem Management Plan (MPEMP) (Haas 2022).

Step 4: The firm maintains a public-facing biodiversity dashboard that contains real-time, detailed, and audited information on the project and the endangered species' abundance (Haas 2022, 2018).

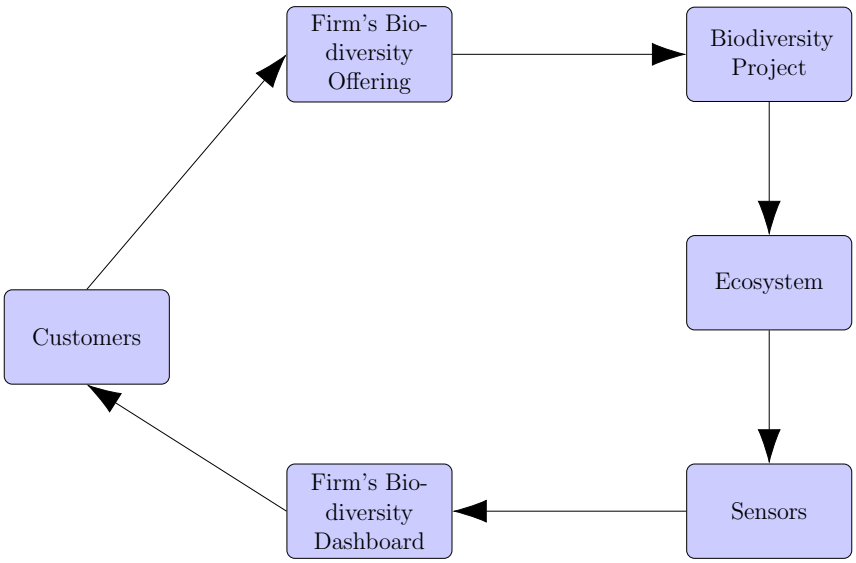

Figure 3: Biodiversity-conserving business plan schematic.

Consultancy Services

- Advice on what critter/plant to focus a biodiversity project on
- Advice on the design of an effective biodiversity project for this endangered species
- Advice on the best biodiversity offering to attach to this biodiversity project
- Guidance, software, and analysis to support a marketing campaign for the biodiversity offering

- Guidance, software, and analysis to maximize the offering-project pair's profitability, political feasibility, and conservation effectiveness.
- Design advice on a political-ecological monitoring system to track the biodiversity project's progress towards sustaining the endangered species
- Design advice on a biodiversity dashboard to display this monitoring data
- Liaison services between a firm and those ecologists contracted to maintain the biodiversity project and its attendant monitoring system

Figure 4: The Amazon has lost a number of its bird species to habitat loss and the illegal trade in exotic birds. (Develey and Phalan 2021).

Business Modeling for Profit and Conservation

Step 3 of the above Business Plan uses a political-ecological model to simulate through time, different offering-project configurations in order to select the one that is maximally

profitable, and has the highest chance of being politically feasible while maximally conserving the endangered species. Characteristics of this model, called a *simulator* are as follows.

Agent-based submodels within the simulator decide to implement actions that affect the endangered species. These agents include poachers, kingpins, consumers, farmers, wildlife protection agencies, governments, and *business agents*, i.e., other firms who are part of the business network that makes up the firm's biodiversity project. The actions of these agents affect and are affected by an individual-based submodel of the endangered species' abundance.

All business agents have customers and a workforce. Buyer-facing agents set prices that were determined during the marketing campaign, and have inventories that they replenish from suppliers. At each time point, all buyer agents update in a random order. Then, all buyer-facing agents update in a random order followed by all supplier agents updating in a random order. An order placed by an agent at one time step is filled within the next time step.

To achieve credibility (Haas 2024b), the simulator is statistically fitted to parsed streams of news articles, and streams of ecological metric observations such as species abundance (Haas and Ferreira 2018). Parsing is performed with new algorithms running on cluster computers.

Biodiversity Conservation Kits

There are three *kits* available at `www.profitablebiodiversity.com`. Each kit contains planning documents that can be used as starting points for a firm's actual set of planning documents that they would use to implement their own offering-project pair. A general description of each of these webpages follows.

Overview: Briefly describes the species chosen for conservation, what biodiversity offering the firm will use to fund its conservation, and what biodiversity project will drive this conservation.

Species: Explains why a particular endangered species was selected for the biodiversity project. Includes the species' home range, probability of extinction, and its threat vectors.

Offering: Describes the product or service that will become the biodiversity offering. This is either an existing offering that the firm is marketing or a new offering specifically designed to appeal to biodiversity-concerned consumers.

Project: Describes the biodiversity project that the firm has designed to help conserve the endangered species. Also describes how the firm's production, marketing, and accounting departments will connect this biodiversity project with its biodiversity offering.

Marketing: Describes all activities that will be implemented to market the biodiversity offering. Details are given as to how demand will be shaped through an appeal to the anxieties of biodiversity-concerned customers worried about species extinctions.

Simulator: Describes all of the submodels making up the simulator. Describes what data was collected for the statistical fitting of the simulator's parameters, and describes the results of this statistical-fitting computation.

MPEMP: Describes how the planned biodiversity project was inserted into the simulator. Describes the MPEMP that was computed with this updated simulator.

Monitoring: Describes what political-ecological metrics will be monitored in order to chart the biodiversity project's effect through time on the endangered species' sustainability. Describes the technology that will be used to both collect this data in real-time, and deliver it to the biodiversity dashboard.

Dashboard: Describes what the biodiversity dashboard will look like. Describes why a particular department in the firm has been selected to be responsible for maintaining the monitoring program and associated dashboard. Describes the contract that has been signed with an auditing firm for the ongoing auditing of the dashboard's data.

Figure 5: Several species of sea turtles are listed as Endangered (NOAA 2022) due in-part to *bycatch* – being unintentionally caught in commercial fishing nets.

Biography

Timothy C. Haas earned a Ph.D. in Statistics from Colorado State University in 1989, served as an acting assistant professor in the Statistics department at the University of Washington during 1989-1990, and assistant and then associate professor in the Lubar College of Business University of Wisconsin-Milwaukee from 1990 to 2024. Emeritus Associate Professor Haas visited the National Center for Atmospheric Research during 1999 and Stanford's department of statistics during 2006-2007.

Dr. Haas has developed semi-parametric methods for prediction of nonstationary spatio-temporal processes, algorithms for the redesign of monitoring networks, Bayesian network models of aspen stand survival, forestry ranger decision making, and integrated, agent-based models of human-wildlife conflict. Support for these endeavors has come from grants awarded by the United States Department of Agriculture, the United States Environmental Protection Agency, and the World Wildlife Fund. This work has been published in the Journal of the American Statistical Association, Forest Science, Atmospheric Environment, Environmetrics, AI Applications, Stochastic Environmental Research and Risk Assessment, Security Informatics, IEEE Transactions on Cybernetics, Ecological Applications, PLoS One, Fron-

tiers in Conservation Science, The Journal of Cybersecurity, Cogent Social Sciences, STAR Protocols, The European Journal of Sustainable Development, and Ecological Modelling. In addition, Dr. Haas has published two books with Wiley on ecosystem management.

References

Develey, P. F. and Phalan, B. T. (2021), "Bird Extinctions in Brazil's Atlantic Forest and How They Can Be Prevented," *Frontiers in Ecology and Evolution,* 9, doi: 10.3389/fevo.2021.624587. https://www.frontiersin.org/journals/ecology-and-evolution/articles/10.3389/fevo.2021.624587

Du, H. and Xiao, T. (2019), "Pricing Strategies for Competing Adaptive Retailers Facing Complex Consumer Behavior: Agent-based Model," *International Journal of Information Technology & Decision Making,* 18(06): 1909-1939, doi: 10.1142/S021962201950038X.

Elfenbein, D. W. and McManus, B. (2010). "A Greater Price for a Greater Good? Evidence That Consumers Pay More for Charity-Linked Products," *American Economic Journal: Economic Policy,* 2(2), May: 28-60.

Garber, P. A., Estrada, A., Shanee, S., Svensson, M. S., Arregoitia, L. V., Nijman, V., Shanee, N., Gouveia, S. F., Nekaris, K. A. I., Chaudhary, A., Bicca-Marques, J. C., and Hansen, M. F. (2024), "Global Wildlife Trade and Trafficking Contribute to the World's Nonhuman Primate Conservation Crisis," *Frontiers in Conservation Science,* 5: 1400613, doi: 10.3389/fcosc.2024.1400613.

Haas, T. C. (2024a), "A New Technology-Based Tool for Building Profitable Biodiversity-Conserving Offerings," *The European Journal of Sustainable Development,* 13(3): 1-13. https://doi.org/10.14207/ejsd.2024.v13n3p57

Haas, T. C. (2024b), "Models Vetted Against Prediction Error and Parameter Sensitivity Standards Can Credibly Evaluate Ecosystem Management Options," *Ecological Modelling*, 498, December, 11090 ("decreases" should be "increases" in the Graphical Abstract). https://doi.org/10.1016/j.ecolmodel.2024.110900

Haas, T. C. (2022), "Profitable Biodiversity," *Cogent Social Sciences*, 8(1): 1-24, doi: 10.1080/23311886.2022.2116814. https://www.tandfonline.com/doi/full/10.1080/23311886.2022.2116814

Haas, T. C. (2018), "Automatic Acquisition and Sustainable Use of Political-Ecological Data," *Data Science Journal*, 17, p.17, doi: 10.5334/dsj-2018-017

Haas, T. C. & Ferreira, S. M. (2018), "Finding Politically Feasible Conservation Strategies: The Case of Wildlife Trafficking," *Ecological Applications*, 28(2), 473-494, doi: 10.1002/eap.1662.

Hanski, I. (2011), "Habitat Loss, the Dynamics of Biodiversity, and a Perspective on Conservation," *Ambio*, 40(3): 248-255. https://doi.org/10.1007/s13280-011-0147-3 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3357798/

Jaureguiberry, P., Titeux, N., Wiemers, M., Bowler, D. E., Coscieme, L., Golden, A. S., Guerra, C. A., Jacob, U., Takahashi, Y., Settele, J., Daz, S., Molnr, Z., Purvis, A. (2022), " The Direct Drivers of Recent Global Anthropogenic Biodiversity Loss." *Science Advances,* 8(45): eabm9982. https://doi.org/10.1126/sciadv.abm9982 https://www.science.org/doi/pdf/10.1126/sciadv.abm9982

National Oceanic and Atmospheric Administration (NOAA) (2022), *Listing Green Sea Turtles Under the Endangered Species Act Final Rule — National*, NOAA. https://www.fisheries.noaa.gov/action/listing-green-sea-turtles-under-endangered-species-act

Petro, G. (2022), "Consumers Demand Sustainable Products and Shopping Formats," *Forbes*, March 11. https://www.forbes.com/sites/gregpetro/2022/03/11/consumers-demand-sustainable-products-and-shopping-formats/?sh=68ad9b456a06

Seyfang, G. (2005). "Shopping for Sustainability: Can Sustainable Consumption Promote Ecological Citizenship?" *Environmental Politics,* 14, 290-306.

Torres-Romero, E. J., Fisher, J. T., Nijman, V., He, F., Eppley, T. M. (2024), "Accelerated Human-Induced Extinction Crisis in the World's Freshwater Mammals," *Global Environmental Change Advances,* 2: 100006, ISSN 2950-1385. https://doi.org/10.1016/j.gecadv.2024.100006