Resource Sufficiency Evaluation: A means to define and manage human development within a 'Safe Operating Space' (SOS)

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There is a growing international realization that humanity's demand for resources has exceeded planetary boundaries, and that global patterns of consumption and production are increasingly unsustainable. With over 7 billion people on the planet and rising levels of affluence, resource overshoot is rapidly degrading the ecological systems that all species depend upon for their survival and wellbeing. The implications are stark. As plainly and boldly stated in a recent UN report, "We must act now to halt the alarming pace of climate change and environmental degradation, which pose unprecedented threats to humanity,"[1]

This growing concern about planetary limits has generated a healthy and long overdue debate about the "safe operating space" (SOS) required for human development. Raworth[2] and others have visualized SOS as a "doughnut" which depicts social boundaries on the inside - with planetary boundaries limiting the exterior circumference - creating a safe and just space between the two in which humanity can thrive. Such visualization is a powerful conceptualization of the challenge we face, but it lacks scale. By itself, it does not tell us whether we have breached our SOS and, if so, by how much. The "doughnut" analogy is helpful, but it does not "provide all the answers."[3] If we are to maintain a SOS, we must do a better job of defining, measuring and explaining the boundaries that make it up.

This paper suggests that resource sufficiency evaluation (RSE) would help to define the outer SOS boundaries and provide policymakers with a clearer understanding of what will be required to stay within them.

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Section 1 – Defining the "safe operating space" for humanity

In determining the scale and limits of a safe operating space for humanity, we must understand how SOS is derived. The equation, in its simplest form, is as follows:

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[1] From the report of the UN High-Level Panel of Eminent Person on the Post-2015 Development Agenda; "A New Global Partnership: Eradicate Poverty and Transform Economies through Sustainable Development", 2nd page of the Executive Summary, item 2.

[2] Taken from the Oxfam discussion paper; "A safe and just space for humanity – can we live within the doughnut?", by Kate Raworth

[3] Ibid.

Equation A:

$$R_{(total)} - R_{(biodiversity)} - R_{(resilience)} = SOS$$

In this formulation:

- $R_{(total)}$ represents the total capacity of the natural resource systems that are available in support our socio-economic activities.
- $R_{(biodiversity)}$ represents the natural resources needed each year to maintain a minimally acceptable level of biodiversity. This recognizes that humanity exists as part of a web of life, not as a stand-alone species, and that we cannot consume the entire resource capacity of the biosphere.
- $R_{(resilience)}$ represents the amount of resources needed to maintain a safety net for humans and the entire socio-ecologic system. Without an adequate safety margin, we may still have operating space, but it is not a "safe" operating space. If you are looking for a real life application of this principle, think of California and its water requirements. California may have operating space, but given the possibility of a major and sustained drought it may not be a "safe" operating space for its 38 million residents.

SOS, in other words, is what's left over of the total resource capacity after we have set aside enough for biodiversity and resilience.

With the application of this formula, the conceptual definition of humanity's SOS fundamentally becomes an issue of ***allocation***. The formula outlined above is intuitively obvious when applied to **renewable** resource categories such as fresh water, forest biomes, fisheries, and more generally the biological productivity of land and marine ecosystems. However, it is also equally applicable to **non-renewable** resource categories such as metals and minerals including fossil fuels, as long as realistic assumptions are made regarding the scale of non-renewable reserves, use rates over time, and the rate of technological advancement which will allow substitution (of alternative renewable or non-renewable supplies) for declining non-renewable reserves.

This conceptual definition of a 'safe operating space' can be universally applied by all nations, and used as a policy mechanism to better understand and ultimately achieve truly durable development. Although it can be employed to evaluate many different categories of natural resource goods and services, we believe that a good starting point would be for all nations to evaluate the material sustainability of their societies and their development aspirations in reference to three important natural resource categories:

a. Fresh water
b. Energy
c. Biological productivity

The first two categories are relatively straight forward in terms of our ability to assess total available capacity and to aggregate our total demands using common units of measure (e.g. gallons or acre-feet of water). The third category is a bit more problematic from an analytical perspective. However, this latter category is most important to fully understand and evaluate quantitatively because "space" in the biosphere is a resource that arguably presents the most severe challenge to achieving further net advances in human development. In the 21st century, "space" in the biosphere has become a critically scarce resource. Consequently, the management and balancing of human development within the confines of this limited resource category, has become one of the greatest challenges to achieving truly *sustainable* development.

The term "biosphere" originated with the geologist Eduard Suess in 1875, who defined it as "the place on earth's surface where life dwells."[4] If we consider this life supporting "envelope" of the earth's circumference as the planet's total capacity to support life, and divide this total capacity into spatially normalized 'portions' of the planet's total terrestrial and marine biomass production capability, we can begin to address humanity's greatest development challenge. When we think about the many different ways that we utilize these biologically productive spaces, we will better appreciate the fact that this resource category, and its effective and sustainable allocation, really does constitute the greatest challenge to the future of sustainable human development. At the same time we will begin to understand its important role in defining and operationalizing the nexus between social, economic, and environmental sustainability.

So how does humanity utilize the resources of the bio-sphere ***and*** still maintain a safe operation space (SOS)? To answer this question we offer the following formula:

Equation B:

$$R_{(\text{food})} + R_{(\text{fiber})} + R_{(\text{building materials})} + R_{(\text{energy biomass})} + R_{(\text{carbon sequestration})} + R_{(\text{land development})} + R_{(\text{waste assimilation/ecosystem maintenance})} \leq \text{SOS}$$

As this formula indicates, our total demand for resources must be equal to or less than the SOS allocation. If our resource consumption exceeds SOS, we are—by definition—not operating within our margin of safety. This formula recognizes that we require resources for multiple purposes: to produce our food (cropland and marine fisheries), to produce fibers and other materials for clothing and shelter (cropland, grazing land, and forest land), and to grow biomass for fuel (cropland and forest land)[5]. We even need resources to absorb our waste products.

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[4] See The Encyclopedia of Earth; http://www.eoearth.org/view/article/150667/

[5] These three uses are often highlighted as humanity's three primary demands on land resources (food, fiber, and fuel). However, humanity's aggregated demands on the biosphere are much greater than just derived from these three land use categories. For example ecosystem services such as fresh water filtration and storage as well as soil retention (forest and

For instance we need biologically active space to sequester the huge volumes of carbon dioxide emissions that the global economy generates annually. This means that the earth's forests must have a net positive growth rate (and a net accumulation of woody mass) in order to provide humanity with net sequestration capacity. Sequestration can also occur if, through enlightened land management practices, soils experience a net accumulation of carbon (cropland, forestland, and grazing land). We also need land for development (cities, roads, etc.) And to complete this very much simplified story of the many ways humanity uses 'space in the biosphere' resources must be set aside to allow for human degradation (e.g. soil depletion or marine system eutrophication) of the bio-systems that would otherwise support life on this planet.

While humanity's safe operating space (SOS) is complex, it can be conceptualized, summarized, and addressed in a relatively straight forward manner. By evaluating total resource supplies, and then ***allocating*** these resource pools across the entire range of resource demands, we can better manage (and optimize) human development within a truly sustainable policy framework.

Section 2 – Resource Sufficiency Evaluation (RSE) and Reporting: <u>Recognizing and addressing the resource allocation challenge</u>

Resource sufficiency evaluation[6] is a "front-end" national planning and policy mechanism that addresses humanity's now critical need to fully consider and properly allocate scarce natural resource assets. This mechanism, at the same time, provides a clear and valid indicator of the material sustainability of human societies. RSE quantitatively assesses each component of equation A, to determine if the national economy is, or has the potential to be, moving forward within a sustainable operating framework that explicitly recognizes resource limitations. The RSE evaluation process is relatively straightforward. For any given natural resource category (e.g. fresh water, energy, or space in the biosphere), the capacity is first calculated using scientifically accepted methodologies.[7] Once the nation's total resource capacity is determined, then a reasonable portion of this total national resource pool can be allocated to maintain 'restricted use' protected areas to preserve bio-diversity.[8] Also a reasonable

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grasslands), and climate regulation (forests) are important for stability of the global environment, and to effectively address the climate change crises. To "re-balance" the earth's carbon cycle we would need massive areas of timber growth (forest land). These latter demands are far greater than just the use of forestland for generating biomass for energy/fuel.

[6] For more information about RSE please refer to the paper "Measuring Sustainability – It's crucial, and it's really not that difficult!" and other papers available at www.swinitiative.com/resources/

[7] These methodologies typically utilize information already available in a variety of international data bases, as well as more refined data which is often available within national statistical bureaus. For determining both the supply capacity and our demands for primary natural resources, methodologies such as life-cycle assessment, input-output modeling, and material flow analysis are available and already being used for these types of evaluations.

[8] The Convention on Biological Diversity (CBD) is an international treaty and forum that has three main goals; conservation of biological diversity, sustainable use of its components, and fair and equitable sharing of benefits arising from the earth's genetic resources. Suggestions for appropriate levels of natural resource 'set-asides' for long-term bio-diversity protection are being made in context with the international CBD negotiations, however, these suggestions are generally viewed as being too politically motivated. It would be wise to get 'second opinions' from respected conservation biologists, before completing the analysis called for in equation A.

allocation of this total resource pool can be set-aside to ensure human resiliency.[9] Although these last two allocations (biodiversity and resiliency) cannot be precisely quantified, reasonable set-aside scenarios can be developed and modeled for each nation.
Once the left side of equation A has been completed, national resource “balance sheets”[10] can be created which, for each resource category, compare the nation’s available capacity (supply) with its actual or projected use (demand) of these resources. When calculating a nation’s resource demands, care must be taken to consider and aggregate all of the various mutually exclusive demands that our societies and economies place on natural resource systems. To this end, equation B is especially useful. The material supply/demand “balance sheets,” thus created, can then be used as a tool to guide public policy decisions.

Section 3 – Treating the causal problem, not just the various symptomatic global crises

There is a growing body of evidence that humanity is collectively and dangerously over-utilizing the planet’s natural resource assets and exceeding planetary “boundaries.” As experts and global leaders more fully comprehend and focus their attention on these limits or “boundary issues,” there is a tendency to define humanity’s “safe operating space” (SOS) in terms of a variety of scientific boundary conditions. However, in so doing, we fail to address the greater causal problem; the over-bearing scale of human activity in relation to the finite natural world, and our **collective** over-use of the earth’s natural capital assets. Yes, climate change, ocean acidification, species extinctions and biodiversity loss, freshwater over-use, and anthropogenic overloading of the nitrogen cycle, are all scientifically relevant challenges that academics and ultimately political leaders must pay attention too. However, if our policy responses are limited to just dealing with these boundary challenges individually and in a scientific framework (in other words; only addressing the symptomatic problems), humanity is unlikely to make significant net progress toward a truly sustainable collective future. Instead, we must understand and define humanity’s SOS in terms of our own development aspirations, and as we design and promulgate our national development programs we must ensure that our economic and social systems can operate successfully and more sustainably within our respective natural resource endowments.

An analogy might be useful here. When we go to a physician complaining of a fever, fatigue, and pain, the doctor will certainly pay attention to these symptoms. But she/he, being a competent practitioner, will also look at the underlying cause of our suffering … which might turn out to be a serious infection or maybe just a passing case of influenza. In either case we would expect to be treated for both the ***symptoms*** and the root ***cause*** of our sickness. Indeed, if we had to choose between the two, in all likelihood we would want her/him to prescribe

[9] Resiliency is a term that is currently in vogue in the international sustainable development discourse. However, the resource demand it represents could just as easily be viewed as an allocation “reserve” or system design “safety factor.”
[10] These material “balance sheets” are done in ‘common unit’ bio-physical terms. No pricing of natural capital goods or services is required.

medicine for the cause of our malady (e.g. antibiotics) rather than just treating the symptoms (e.g. pain pills).

In a like manner, humanity's over-use of limited natural resources is the causal driving force behind a variety of symptomatic environmental challenges. Yes, we need to address and monitor these symptomatic problems closely, but in addition to focusing on and better managing these important external environmental systems, we also need to design and implement an appropriate policy response to the fundamental causal problem: our overuse of natural resources. We need to create a more appropriate balance between our total development aspirations and the capacity of the planet to support our long-term well-being.

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This paper, in section 2, has proposed a robust and universally applicable policy mechanism called resource sufficiency evaluation (RSE) which, when implemented, will enable all countries to determine whether their consumption levels exceed sustainable supply capacities. With this information in hand, planning and development ministries will be better informed and able to make appropriate adjustments to their national plans and development policies in order to ultimately balance their society's consumption with these capacities.

It is clear that the world must "… strike a better balance between the economic and social prosperity of its people, while better managing its resource base."[11] The implementation of this global balancing requirement must occur at the national planning and policy scale. RSE provides a robust and operationally straight-forward policy mechanism for all nations to deliver on this objective.

In collaboration with many civil society partners and members of the United Nation's Open Working Group (OWG) on the Sustainable Development Goals (SDGs), we would encourage all countries to support the joint statement reproduced on the next page, which calls for a universally applicable <u>target</u> to incorporate natural resource sufficiency accounting into national planning processes.

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[11] Taken from the "Foreword" (page 11) of UNEP's International Resources Panel report; "Assessing Global Land Use: Balancing Consumption with Sustainable Supply"

A Joint Statement:

Calling for a <u>SDG target</u> that would incorporate "natural resource accounting" into country-level plans for achieving SCP.

Sustained and inclusive economic development requires water, energy, metals, and mineral resources. Natural resources and the preservation of bio-capacity are foundations for delivering human wellbeing and dignity. Food security can only be achieved with adequate water, topsoil, and arable land. Human health depends upon sanitary conditions and access to safe drinking water.

The natural resources and services that underpin human development are assets. Just as governments need financial balance sheets and budgets to manage their ***fiscal*** affairs they also need natural resource balance sheets and budgets to manage their ***physical*** resources and preserve their bio-capacity. Just as countries must be wary of incurring unsustainable ***budget deficits***, they must also be concerned about ***ecological deficits*** and the depletion of scarce resources.

The quest for ***sustainable*** development should include national inventories of natural resources and a rigorous assessment of bio-capacity. Sustainable consumption and production is at the heart of sustainability. Developed and developing nations alike must assess their natural material balance sheets in order to be able to identify the best and most sustainable development pathways. Long-term, sustained poverty eradication demands that countries anticipate and guard against problems arising from resource scarcity or environmental degradation.

As part of the Sustainable Development Goals (SDGs) all countries are encouraged to commit to elaborating natural resource balance sheets, as a tool that can guide public policy decisions. To that end, the SDGs should establish the following universal **<u>target</u>**:

<u>Natural Resource Accounting</u>: All nations should conduct natural resource sufficiency evaluations at the country level, produce annual material resource "balance sheets," and integrate this information into their national plans for achieving sustainable production and consumption.