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Policy Coherence of the Sustainable Development Goals

A Natural Resource Perspective

International Resource Panel

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Policy Coherence of the Sustainable Development Goals

A Natural Resource Perspective

An International Resource Panel Report

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Preface

Under the aegis of the United Nations, the international community is expected to commit to a path-breaking Global Sustainable Development Agenda in September 2015. The Sustainable Development Goals (SDGs), a set of 17 goals and 169 targets to be achieved by 2030, form the core of the Post-2015 Development Agenda. The SDGs have evolved through an intense process of worldwide consultation, with a level of official and public participation that is unique in the history of the UN. While the process has had to reconcile views and inputs of great variety in scope and content, this outcome certainly presents a hopeful sign for securing the future of all humanity and life on Earth.

The International Resource Panel (IRP) has been informing the process of SDGs development over the past two years. Panel members participated in meetings of the United Nations Open Working Group (OWG), expert consultations, and other events as part of this international process. In January 2014 the IRP launched '*Managing and Conserving the Natural Resource Base for Sustained Economic and Social Development*', a think piece highlighting the importance of sustainably managing resources as a basis for social and economic development and presenting examples of how objectives for such management could be integrated into the SDGs. The current formulation of the SDGs expresses a clear recognition of the importance of sustainable resource management, and of the maintenance and safeguarding of natural capital, if humanity's hopes of sustainable development for all are to be fulfilled.

This recognition is an important step forward for the global community in terms of its acceptance of the need to adopt development strategies that take into account the constraints of nature's limits. These strategies will need to be different from those which have been pursued in the past, and will need to result in patterns of consumption and production that are far more efficient with respect to use of Earth's resources and the consequent impacts on the environment. In particular, these strategies will require that the objectives expressed in those SDGs that are concerned with the sustainable management of resources and the environment are pursued simultaneously with and as vigorously as those which are concerned with economic and social improvements. Indeed, the economic and social improvements will only be achieved on a lasting basis if they are underpinned by a secure foundation of natural capital, which supports all life on Earth.

This new assessment report is a follow-up to the earlier think piece and examines the resource interlinkages and potential trade-offs in the SDGs. It shows how and why the SDGs will need to be pursued together, as a whole, if sustainable development is to be achieved. This approach contrasts starkly with the spirit of 'grow now, clean up later', that has led to the current situation of resource and environmental conditions in many parts of the world that cannot, or soon will not be able to, support human populations that depend on them or enable the aspired level of human development. The paper identifies the kinds of resource-related factors that decision-makers will need to take into account in formulating policies and actions for implementing the SDGs, that will need to bring about fundamental shifts in current production systems and consumption patterns.

We would particularly like to thank Michael Obersteiner and his group from IIASA for their initial suggestions and technical analysis, and Zeenat Niazi's team from Development Alternatives, for their support in carrying out this assessment. We would also like to thank all IRP members for their valuable insights and contributions to the assessment.

Achieving the social and economic progress envisaged in some SDGs requires the simultaneous investment in natural capital envisaged in others. Pursuit of the former and delaying action on the latter will not work. This implies a radical transformation in how policy-makers prioritise issues relating to the use of natural resources and the environment.

Janez Potočnik
Co-Chair, IRP

Ashok Khosla
Co-Chair, IRP

Executive Summary

- The Sustainable Development Goals (SDGs) aim, by 2030, to end human deprivation worldwide. They represent a coherent, collective vision of a better future for all and provide a framework by which progress towards this vision may be monitored.
- The confluence of current trends in population growth, changing lifestyles, urbanization and economic activity are increasing pressures on natural resources and the environment. Signs of escalating and compounded stresses are evident at global, national and local levels and are reflected in local and regional scarcities of vital resources like water, widespread land degradation and the exceeding of critical global thresholds leading to the disruption of Earth System processes (such as climate regulation and the nitrogen cycle). Combined with, and leading to, rising inequalities and social conflict, the by-products and side effects of current development trajectories could well, in the not too distant future, create insurmountable obstacles to the international community's efforts at improving human well-being, and even lead to cascading risks of losing the development gains achieved so far.
- One of the great strengths of the SDG framework in its current formulation is its recognition of the intimate links between human well-being, economic prosperity and a healthy environment. In its adoption, it must send out a clear message that restoring and maintaining the health of the natural resource base is a necessary condition for eradicating poverty and sustaining economic progress for all.
- Highest priority must now be given to policies and actions that promote and enable radical decoupling of economic growth from natural resource consumption and environmental impacts. Such measures will need to lead to great increases in resource efficiencies of the world's production systems and increased sustainability in the lifestyles its peoples lead. This requirement is so fundamental that Sustainable Consumption and Production (SCP) has been given both an over-arching status *and* a specific goal among the 17 SDGs.
- Many initiatives and experiments over the last two decades have shown the kinds of economic, social and environmental benefits which SCP approaches can achieve. However, given the slow progress to date in scaling up and replicating these initiatives, renewed political, economic and technological commitments to these approaches are required. The approaches themselves are well understood, and include fiscal and regulatory reforms that internalize the costs of damage to natural resources and the environment, thereby facilitating the accelerated adoption of lifestyles and systems of production based on waste minimization, product life extension, extended producer responsibility, reuse, recycling, remanufacturing and other methods that effectively conserve resources and reduce pollution, thereby improving human well-being over the long term.
- Modelling carried out for this report shows that policies designed to address a limited set of goals, for example only one of the three dimensions of sustainable development,

can impede progress for the other dimensions, and have negative impacts on human well-being overall. Outdated strategies that take inadequate account of the Earth's resources and natural capacities, in particular, often have major unintended consequences for the health of the economy, society and natural environment, usually by shifting the problem being addressed to another country, social group or environmental medium, or by stunting the development of another sector. The SDGs have been designed to address *all* of the dimensions of sustainable development – economic, social and environmental – in the recognition that progress will need to be made on all of them together, and that policies for implementing them need to be based on a systemic understanding of the different goals and be designed as an integrated, coherent package managing for co-benefits and mitigating the effects of trade-offs.

- While SDGs are formulated on global levels most of the action to implement the SDGs will necessarily be at national and sub-national levels. It is at these scales that a comprehensive integration of resource concerns in policy, planning and implementation will set the stage for a net positive outcome at the global level. Countries and communities are at different levels of socio-economic development and technological attainment and have widely different access to natural resources. Strategies and solutions to implement the SDGs will therefore have to be designed according to their specific circumstances in a globally consistent manner. Given current environmental and resource challenges, they will all need to pay close attention to resource conservation and the maintenance of vital Earth system functions. The more developed economies will need to adopt strategies that bring their resource consumption down to globally sustainable levels (*absolute decoupling*), including by developing cleaner technologies and deploying them at scale. At the same time, developing nations must strive to improve resource efficiencies and cleaner production processes even as their net consumption of natural resources increases for a period until they achieve a societally acceptable quality of life (*relative decoupling*).

- This will require new programmes of research, development, deployment and transfer of information, knowledge and technology on an unprecedented scale. The programmes will need to be based on credible integrated impact assessments at domestic levels but in global contexts, capacities for which may need to be strengthened in many developing countries. International cooperation will need to address the gaps in financial, technological and institutional capacities to enable developing nations to accelerate their adoption of sustainable modes of production and improved well-being. And, at the same time, investments in new energy, transport and urban infrastructures will need to facilitate the adoption of less resource-intensive lifestyles and consumption patterns.

- Nations of the world, and the global community of nations, are at the cusp of a historic challenge and opportunity. Environmental management and socio-economic development now need to be pursued together, if either is to be achieved. Sustainable prosperity for current and future generations requires the maintenance and restoration of ecosystem health. The SDGs process has the opportunity of inaugurating a new era of policy-making that makes a reality of the simultaneous integration of economic, social and environmental imperatives.

Key Considerations for Policy Formulation and Action

In the adoption and implementation of the SDGs, it will be essential for the international community to:

1. **Maintain a Sustainable Resource Management perspective that recognises restoration, conservation, *efficiency and decoupling* strategies as being critical for fulfilment of the SDGs. This will require**

   a. prudent management and use of natural resources, given that several Goals are inherently dependent on the achievement of higher resource productivity, ecosystem restoration and resource conservation.

   a. introduction of practices based on a "circular economy" approach, which raise resource productivity and reduce wastes through reusing, recycling and remanufacturing products and materials in order to decouple natural resource use from economic progress.

2. **Promote synergies and avoid environment-development trade-offs among the Goals through comprehensive analysis of natural resource and socio-economic system interactions. This will require**

   a. careful consideration and management of the linkages among different resources and between these and socio-economic and governance systems.

   b. finding ways to meet human development needs through environmental conservation at different levels and scales.

3. **Create coherence and coordination among policy strategies for achieving multiple SDGs in order to achieve co-benefits and to avoid counterproductive results. This will need**

   a. commitment to maintaining the integrity of Earth's systems while addressing the resource demands driven by individual Goals.

   b. integrated approaches that take account of the many interactions between different natural systems, and between these and human economies and societies.

4. **Adopt consumption patterns and production systems that contribute to human well-being without putting unsustainable pressures on the environment and natural resources. This will need:**

   a. a fundamental reorientation of infrastructures, investments, and technologies, and policies to introduce incentives that promote SCP.

   b. promoting innovations in technology and governance systems integrating the global, national and local levels that deliver the sustainable management of natural resources.

5. **Build national capacities for integrated policy assessment, technological innovation and financial mobilization to enable countries to formulate and implement integrated strategies that will lead to sustainable socio-economic development, and the achievement of the SDGs. This will need**

   a. global cooperation and trade to stimulate technological and institutional innovation at regional, national and local levels.

   b. fostering of widespread awareness of resource and environmental issues among decision-makers, businesses, scientists, the media, civil society and the public, generating a momentum to redesign policies and institutions necessary for the transition needed towards more sustainable development paths.

   c. creation and dissemination of observation platforms and decision support tools to support transparent, consistent, complete and accurate assessments of strategies and programmes aimed at achieving the SDGs, as well as enabling learning through monitoring outcomes and policy evaluation.

Contents

Background

The UN's Development Goals

At the United Nations Millennium Summit in 2000, world leaders adopted the Millennium Development Goals (MDGs). These eight goals committed the international community to achieving a variety of specified development targets by the year 2015, mainly aimed at removing the worst manifestations of poverty in developing countries. Over the past fifteen years, governments and UN agencies have devoted significant attention and finance towards the achievement of these goals, with varying degrees of success. The term for implementing the MDGs comes to an end in September 2015.

To maintain the momentum of the MDGs process after its completion, Sustainable Development Goals (SDGs) were proposed in 2012 at the United Nations Conference on Sustainable Development (Rio+20). The UN General Assembly subsequently set up a process involving extensive consultation worldwide, to lead to the adoption of SDGs, which would guide international action towards sustainable development from 2015 to 2030. Unlike the MDGs, the SDGs are intended to be universal in scope, and applicable to the concerns of both developing and developed countries.

In July 2014, the Open Working Group (OWG), a body set up by the UN General Assembly as a platform to facilitate extensive consultations on the SDGs, put forward proposals for SDGs that constitute a global agenda for sustainable development that is ambitious, universally applicable, and truly transformative (UN, 2014). This proposal was supported by the Synthesis Report of the Secretary-General on the Post-2015 agenda – *The Road to Dignity by 2030: Ending Poverty, Transforming All Lives and Protecting the Planet* – issued on December 4, 2014 (UN, 2014). The SDGs are expected to be adopted at the UN General Assembly in September 2015.

The SDGs process, backed by extensive research and consultation on the multiple facets of sustainable development, highlights the interdependence and complexity of the interlinked environmental, social and economic problems now confronting decision-makers. It further affirms a commitment of the international community to take hard decisions in order to ensure the "*future we want for all*".

Echoing the commitment to a just, equitable and inclusive world as spelt out in the Rio+20 outcome document, eradication of poverty was identified as the greatest global challenge and an "indispensable requirement for sustainable development". Therefore, freedom for all from poverty and hunger is given the highest priority in the SDGs.

However, sustaining this freedom for current and future generations will require the protection and careful management of Earth's natural resource base involving a transition to more sustainable consumption and production patterns, as set out in subsequent SDGs.

Irreversible climate change and biodiversity loss - to name just two risks stemming from exceeding critical thresholds for the health and function of Earth Systems — has illustrated the strong interdependencies among natural resource cycles, Earth's biosphere, and socio-economic and governance structures. These risks highlight the importance of connecting policy strategies and actions for poverty alleviation, sustained economic growth and social cohesion, to strategies and actions for the conservation, regeneration, efficient use, and equitable management of natural resources within and across national borders and multiple generations of people.

The Open Working Group Synthesis of Goals and Targets

The OWG proposed a comprehensive package of 17 goals and 169 targets (available at https://sustainabledevelopment.un.org/sdgsproposal) that are grounded on three common principles stemming from the convergence between the MDGs and the outcome of Rio+20:

- **Leave no one behind;**
- **Ensure equity and dignity for all; and**
- **Achieve prosperity within Earth's safe and restored operating space.**

The SDGs express a new recognition of the facts that: (a) human well-being is intrinsically linked to the health of the natural ecosystem; (b) global environmental challenges not only constrain the development of the poorest, but also pose a threat to the long-term prosperity of developed economies; and (c) addressing inequities in the distributive benefits of development is critical for global sustainable development (Loewe, 2012).

At the macro level, the concepts of a 'social floor'[i] and an 'environmental ceiling'[ii] are enunciated in the spirit of the design of the goals and targets. Social priorities of the Member States in the run-up to the 2012 Rio+20 Conference helped define the primary dimensions of the social floor. Earth-system science, including the research on planetary boundaries (Stockholm Resilience Centre, 2009), has provided evidence and generated new understanding of the limits to the ability of ecosystems to continue to deliver vital goods and services under current anthropogenic pressures, thus identifying specific elements of 'environmental ceilings' at global and local levels.

Interlinkages between Goals and Targets

The OWG proposal integrates and reflects the human development agenda (Raworth, 2012) in the design of the goals and in the quantification and interconnectedness of targets[iii]. If materialized, these targets are expected to be sufficient to raise everyone above the minimum social floor. In this way, they build upon and reach beyond the unfinished MDG agenda.

Resource requirements and ecosystem health are linked, directly or indirectly, to several goals. It is critical to ensure that efforts to achieve human well-being and economic prosperity dimensions of the SDGs do not become self-defeating by violating the limits of the environmental resource base.

Analyses by various groups[iv] have indicated that 12 of the 17 Goals[v] promote human well-being through sustainable use of natural resources. Furthermore 10 Goals can be achieved only if consumption efficiencies for land, water, energy (fossil fuels and bio-fuels[1]), materials and other finite resources are raised substantially. They also argue that ecosystem restoration and resource conservation strategies should be integrated into national and international policy and law.

1 In 2009 the International Resource Panel published a scientific assessment report, *Towards sustainable production and use of resources: Assessing Biofuels* which examined the interaction of biofuel production with a number of global trends, including population growth, changing nutrition patterns, yield improvements and climate change.

Goals 12 through 15 of the SDGs focus on strategies for mitigating and eventually reversing the negative impacts of economic development on ecosystems and the services they provide. In particular, Goal 12 aims to reshape consumption and production patterns to reduce the pressure on resources while promoting human and economic development.

While the SDG framework implicitly recognises links between human well-being and ecosystem health, individual human and social Goals (1 through 11) are more thoroughly integrated into the comprehensive vision of the SDGs than the goals that address ecosystem health (le Blanc, 2015). More attention is needed to articulate co-benefits, or points of mutual reinforcement, between the socio-economic objectives, and targets for environmental quality and sustainable resource management targets[vi].

Challenges to the achievement of the SDGs

Current trends in population growth, lifestyle changes and economic activity are powerful drivers behind escalating resource use and related environmental degradation[7]. In the next 20 years, more than 3 billion people are expected to enter the middle class (as measured by income levels and consumption patterns) in addition to the 1.8 billion today. These growing trends will greatly intensify the global extraction and use of resources, which based on current trends is expected to reach 140 billion tons annually by 2050 (three times the amount recorded for the year 2000) (UNEP, 2011). This will put enormous pressure on the Earth's natural resources and environment, many of which are already showing serious signs of scarcity and stress at local, regional, and global levels. All the evidence suggests that climate change will further intensify this pressure, with the risk of triggering substantial changes to the biosphere that greatly reduce its ability to deliver goods and services essential to human well-being.

The SDGs are the expression of the global community's determination to achieve ever-increasing living standards for all, including the eradication of poverty, while maintaining a habitable environment.

In the past many socio-economic and environmental objectives have been experienced as trade-offs. The adoption of the SDGs represents the global community's determination to break with this historical experience and achieve synergies between the objectives, rather than trade-offs.

However, the risk of trade-offs remains (see Annexure B). Avoiding this risk, and achieving the SDGs synergistically, will require concerted policy action at multiple levels (global, regional, national and local).

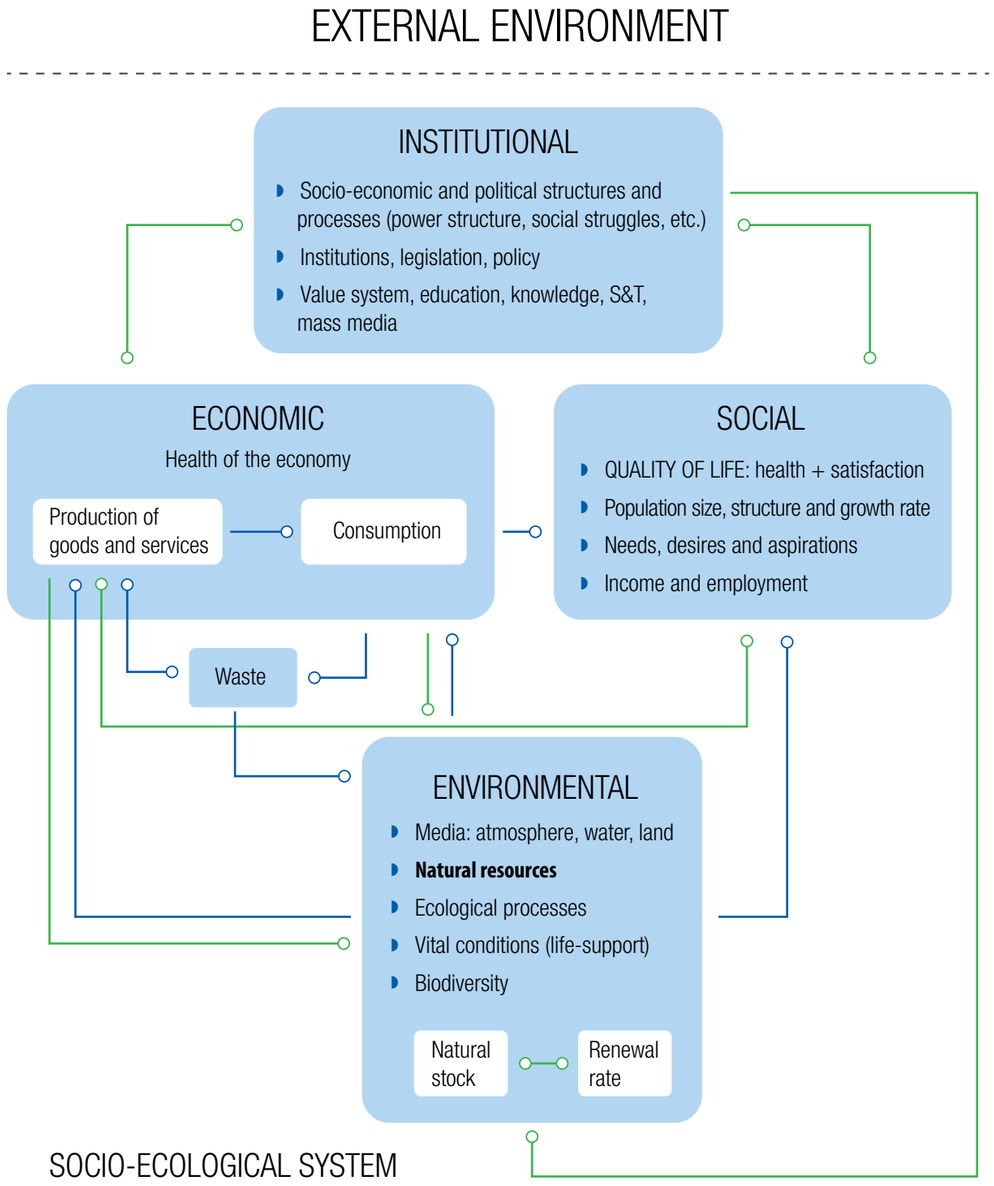
These policies need to anticipate and resolve possible resource conflicts and enhance co-benefits among the SDGs. They need to generate a new set of resource management strategies that address the entire ensemble of SDGs, avoiding zero-sum outcomes and leading to net positive results across the SDGs as a whole.

The Natural Resource System and Socio-Economic System Interactions – A Nexus Perspective

Modern socio-economic planning systems increasingly recognise the importance of integrated approaches to resource management and development. These systems consider natural resources as key components of the complex interconnected systems which constitute the economy embedded in the larger society, which is in turn embedded in the global ecosystem. The International Resource Panel takes into account these socio-economic system interactions in its 'nexus perspective' on sustainable resource management (see Figure 1).

Interconnections among sub-components of the natural resource system[8]—i.e. water, minerals, energy and food—must be expected to transmit and compound the pressure of the anticipated rapid growth in resource demand [30 to 40 per cent growth in resource demand by 2030 in some estimates (Clara et al., 2013)] throughout the land system, directly and indirectly exacerbating existing resource scarcities. For example, studies on the Water-Energy-Food nexus over the last decade have demonstrated that "long-term sustainability requires acknowledging that many

Figure 1. The socio-ecological system



Source: amended from Gallopín, G.C. (2011).

of the resources that support development – water, land, materials are finite and are also needed to support vital ecosystem services. Development can only be sustainable, if it works within those bounds, over time and across sectors and locations." (Weitz, 2014).

Studies emphasise different facets of this nexus perspective. A report by Chatham House (Lee et al., 2012) states that "Resource systems are closely interlinked at the local level and – through markets, trade and the global environment – increasingly at the global level too." The IRP[2] identifies as part of the resource nexus all the natural resources used by economies, including energy, metals[3], minerals, and biomass, (including food, water and land), further expanding this list to include food, fibre, fodder, fuel, fertiliser and timber under biomass; freshwater and marine resources under water, and different land uses such as built/urban, agricultural, forest [also biomass] and habitats/ eco-systems [with linkages to freshwater and seas] under land.

The nexus perspective is an example of systems thinking based on the fact that the interlinkages among natural resources are significantly affected by complex interactions with institutional, societal, economic aspects as well as with human behaviours that play out differently at different scales of operation (local, regional, global).

Bleischwitz et al. (2013) examined the interlinkages between resources and their relationship with global supply chains to demonstrate the impacts of food production and water stress on extraction activities in fragile states and regions. They found that conflicts are likely to increase in countries that are significant global suppliers of resources. Such conflicts may put at risk industries with extended, complex and inflexible resource supply chains (Bleischwitz et al., 2013). This dynamic is illustrative of the interactions between the natural resource system and socio-economic and geopolitical processes. Socio-economic systems (SES) (Gallopín, 1991), in turn, are deeply affected by, and influence in their turn, the governance of resources, climate change impacts, conflicts or geopolitical factors. These connections between natural resources and social and political realities pose existing and future risks, threats, and opportunities that must be taken fully into account by policy processes related to achieving the SDGs.

2 http://www.unep.org/resourcepanel/Portals/50244/documents/IRP_Draft_Glossary.pdf

3 The International Resource Panel work on global metal flows has led so far to the publication of four scientific assessment reports looking at various aspects of sustainable metals management, including metal stocks in society, metal recycling rates and opportunities for its increase, and the various environmental challenges associated with metals extraction and use. In addition to these reports, a working paper on long-term estimates of geological stocks of metals has been published, where some usable estimates are available. The knowledge contained in the four reports and the working paper provides a comprehensive overview of a variety of policy-relevant findings and opportunities for policy-makers to take into consideration towards the development of policies and regulations aimed at promoting sustainable metals management from a life cycle perspective.

The Coherence of the Earth System – Planetary Boundaries and their Interdependencies

The concept of planetary boundaries, related to nine resource and environmental themes[ix], identifies a 'safe operating space' for human activities, remaining within which permits the sustainable functioning of a set of key Earth-system processes. In a growing body of research since 2009, scientists have argued that "the stable functioning of the Earth-system is a pre-requisite for thriving societies around the world" and that crossing these boundaries, meaning that human activities are outside the safe operating space, could generate abrupt or irreversible environmental changes (Stockholm Resilience Centre, 2009).

The studies have indicated that the boundaries, like the processes themselves, are interdependent and their "interactions can create stabilizing or destabilizing feedbacks, thus making it necessary to simultaneously address various interacting environmental processes (e.g., stabilizing the climate system requires sustainable forest management, stable ocean ecosystems, etc.) leading to tipping points in the Earth system" (Schellnhuber, 2007[4]). Crossing the boundary related to any one environmental theme is likely to magnify effects across the system. Recent research indicates that four out of nine of these 'planetary boundaries' have been breached with human activity as the primary cause (Bringezu, 2015; Kilisek, 2015).

In addition to this concept, which provides an overarching guide for policy action and development on how to keep human activities within a safe operating space in relation to overall use of the environment and resources, policy will also need to take account of distributional issues concerned with who has access to these goods and services, and who benefits from them.

4 www.pnas.org/content/105/6/1786.full

Understanding Synergies, Conflicts and Trade-offs

The sustainable management of natural resources will be critical for the fulfilment of the SDGs. Of the 17 Goals proposed by the Open Working Group (OWG), progress towards 12 directly depend upon the sustainable utilization of natural resources. Current trends of escalating unsustainable exploitation and use of natural resources will affect their future availability and accessibility and is therefore likely to impede the fulfilment of the Goals, particularly eradication of poverty and as well as disrupt critical earth system processes. Further, as natural resources are intrinsically interlinked, pathways and policies designed to accomplish one SDG may either enhance or impede progress towards numerous others, across the whole spectrum of Goals.

For example, examining the SDGs from a resource perspective indicates that comprehensive greenhouse gas mitigation policies in the agricultural sector can achieve significant improvements in nutrient efficiency improvements, water savings and conserve biodiversity, while the production of adequate and nutritious food in absence of a conducive SDG policy setting could increase competition for already stretched resources such as water, land and energy (Obersteiner et al., 2015). Agricultural intensification, forest and biodiversity conservation, climate change mitigation, soil health maintenance, and freshwater protection are each included among the SDGs as fundamental goals, yet all entail potential synergies and trade-offs with other objectives. Through their net effects on resource supply and demand, strategies for implementation must be targeted towards the maximum delivery of co-benefits and mitigation of trade-offs across multiple SDGs and thereby determine the success or failure of the total initiative.

Any cluster of policy strategies that impose a net pressure on the finite resource system will strain food, feed, fibre, energy production systems and will lead to stunting development efforts on the one hand or shifting the problem elsewhere and increased earth system impacts such as biodiversity loss, climate change on the other. However, potential trade-offs can be anticipated and managed by strategically planning the scale and timing of proposed actions at different global, national, and local levels.

If for example the SDGs on energy, food security and climate change are pursued by sectorial policies then there are strong potential trade-offs between food system, biodiversity, climate mitigation, nutrient pollution, freshwater use, and forest conservation policies. However, if these policies are combined and coordinated with efficiency enhancing SCP measures affecting both demand and supply (or production and consumption) and if embedded in a carefully designed system of environmental and social safeguards the efforts to achieve these combined goals are dramatically reduced compared to the sum of individual policies. For example, the climate change goal cannot be coordinated and achieved unless the energy goal focuses on safe, clean and low-emission technologies; or progress on social goals such as access to drinking water and nutritious food, will impact upon land and water resources.

Doubling agricultural productivity (target 2.3) could risk ensuring sustainable and resilient agriculture (target 2.4) unless the two are achieved together.

There will be a need to cater to demands for water for drinking, sanitation for all, agricultural needs, infrastructural requirements and various water intensive production processes. With limited water availability, and continuous depletion as well as degradation of water resources through households and industrial effluents, the world will face scarcity of water and will fail to accomplish the SDGs. The first steps to prevent such resource exhaustion are thus to manage resources in a sustainable manner and a judiciously use them for fulfilment of the SDGs.

Targeted strategies that aim to deal with food production/security, energy production and water security (SDGs 2, 6, 7) through dependence on the same land systems – that is also subject to conservation strategies for bio-diversity (SDG 15) – will put increasing pressure on land use and magnify trade-offs between SDGs. Thus, restricted land use change mitigates destruction of natural forests as well as greenhouse gas (GHG) emissions, increases ground water for agriculture and has a positive environmental outcome. However, it can have the effect of decreasing food availability among vulnerable populations due to limited land available for agriculture, and restrictions on overall crop production. Shifts in production systems that address structural inefficiencies, resource productivity and resource conservation strategies will reduce pressures on land, water and energy to meet the targets of food security, energy access, water security and climate resilience only to a limited extent. However, further policies addressing the demand-side, such as consumption patterns, will also be required.

Policy strategies that address single Goal outcomes are therefore unlikely to be successful. Integrated and comprehensive policies are therefore essential to the success of the SDG vision, ensuring that multiple Goals can be met simultaneously.

Table 1: Interlinkages between the SDGs and Related Resource Requirements

	Goals	Goal Interlinkages	Target Interlinkages	Resource Efficiency Required	Resource Conservation Strategy Required
Goal 1	End poverty in all its forms everywhere	2 (Food); 3 (Health); 4 (Education); 5 (Gender); 8 (Eco growth and employment); 9 (Infrastructure and industrialisation); 10 (Inequality); 11 (Cities); 13 (Climate); 14 (Oceans and marine Resources); 15 (Ecosystem and biodiversity)	2.1; 2.3; 2.4; 10.1; 10.2; 11.1	Medium	Access to food, water, energy, sanitation will lead to poverty eradication
Goal 2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	1 (Poverty); 5 (Gender); 10 (Inequality); 13 (Climate); 15 (Ecosystem)	1.3; 1.4; 1.5; 12.3; 15.6	Very High	Sustainable intensification of agriculture Controlled agricultural run-off Resource efficiency for production and processes Minimisation of food wastage
Goal 3	Ensure healthy lives and promote well-being for all at all ages	5 (Gender); 6 (Water and Sanitation); 10 (Inequality); 11 (Cities); 12 (SCP)	1.3; 5.6; 6.2; 6.3; 11.2; 12.4; 16.1	High	
Goal 4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	9 (Infrastructure and Industrialisation); 10 (Inequality); 12 (SCP); 16 (Institutions)	1.3; 8.6; 12.8; 13.3; 16.1; 16.2	Medium	
Goal 5	Achieve gender equality and empower all women and girls	3 (Health); 8 (Eco growth); 9 (Infrastructure and Industrialisation); 10 (Inequality); 16 (Institutions)	1.4; 2.1; 2.2; 2.3; 3.1; 3.7; 6.2; 12.2; 16.1; 16.2; 16.7	Medium	
Goal 6	Ensure availability and sustainable management of water and sanitation for all	3 (Health); 5 (Gender); 9 (Infrastructure and Industrialisation); 10 (Inequality); 12 (SCP); 15 (Ecosystem and biodiversity)	3.9; 9.1; 9.4; 12.2; 12.4; 12.5; 13.1; 15.1; 15.4	Very High	Efficient use of water for energy, infrastructure construction, agriculture, etc.
Goal 7	Ensure access to affordable, reliable, sustainable and modern energy for all	9 (Infrastructure and Industrialisation); 10 (Inequality); 12 (SCP)	9.4	Very High	Efficient use of energy for, infrastructure construction, water generation, etc.
Goal 8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	4 (Education); 10 (Inequality); 12 (SCP); 14 (Oceans and marine resources); 16 (Institutions)	1.4; 4.1; 4.3; 4.5; 5.4; 7.1; 7.2; 7.3; 9.1; 9.2; 9.3; 10.1; 10.3; 10.4; 10.5; 12.1; 12.2; 12.4; 12.5; 12.6; 14.7; 16.2; 16.7	High	Decoupling of economic creation and employment from resource use
Goal 9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	6 (Water); 7 (Energy); 8 (Eco growth); 10 (Inequality); 12 (SCP); 13 (Climate)	1.4; 1.5; 6.2; 6.4; 6.5; 7.1; 7.2; 7.3; 10.5; 11.1; 11.2; 11.5; 12.2; 12.4; 12.5; 12.6; 13.1; 13.2	Very High	Resilient infrastructure
Goal 10	Reduce inequality within and among countries	1 (Poverty); 8 (Eco Growth); 9 (Infrastructure and industrialisation); 16 (Institutions)	1.1; 1.2; 1.4; 2.1; 2.3; 3.8; 4.1; 4.5; 5.1; 5.5; 6.1; 6.2; 7.1; 7.2; 7.3; 8.1; 8.5; 8.6; 8.7; 8.10; 9.1; 9.2; 11.1; 11.2; 16.7	Medium	
Goal 11	Make cities and human settlements inclusive, safe, resilient and sustainable	1 (Poverty); 3 (Health); 9 (Infrastructure); 10 (Inequality); 12 (SCP); 13 (Climate); 14 (Oceans and marine resources); 15 (Ecosystem and biodiversity)	1.3; 1.5; 3.6; 16.7	Very High	Efficient use of resource for construction, transport, and infrastructure
Goal 12	Ensure sustainable consumption and production patterns	2 (Food); 3 (Health); 4 (Education); 5 (Gender); 6 (Water and sanitation); 8 (Eco growth); 9 (Infrastructure and industrialisation); 13 (Climate); 14 (Ocean and marine resources); 15 (Ecosystem and biodiversity); 16 (Institutions)	2.4; 3.9; 4.7; 6.1; 6.3; 6.4; 7.1; 7.2; 7.3; 8.4; 8.9; 9.1; 9.2; 9.3; 9.4; 11.6; 13.1; 13.3; 14.1; 14.3; 14.6; 14.7; 15.2; 15.3; 15.4; 15.5	Very High	Will be resource efficient provided there is resource efficiency along the other 11 goals
Goal 13	Take urgent action to combat climate change and its impacts	4 (Education); 6 (Water and sanitation); 9 (Infrastructure and industrialisation); 12 (SCP); 16 (Institutions)	1.5; 2.4; 9.1; 11.5	Medium	Will be resource efficient provided there is resource efficiency along the other 11 goals
Goal 14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development	9 (Infrastructure and industrialisation); 12 (SCP); 13 (Climate); 15 (Ecosystem and biodiversity); 16 (Institutions)	1.4; 1.5; 12.2; 15.1	Very High	Local to national resource management
Goal 15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	2 (Food); 6 (Water); 12 (SCP); 14 (Oceans and marine resources); 16 (Institutions)	1.4; 2.4; 2.5; 6.6; 12.2; 14.1; 14.5	High	Local to national resource management
Goal 16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.	3 (Health); 4 (Education); 5 (Gender); 8 (Eco growth); 10 (Inequality); 11 (Cities)	3.7; 4.3; 4.6; 5.2; 5.5; 8.2; 8.3; 8.8; 10.2; 10.3; 10.6; 10.7; 12.6; 14.4; 14.6; 15.9	Medium	

Adapted from: le Blanc, 2015; Cutter et al., 2015; Bringezu, 2015; IGEP, 2015; Waage et al., 2015 and UNEP, 2015.

Comprehensive Policy Responses to Achieve the SDGs

Economic: The economic consequences of current patterns of resource use are already apparent in rising resource prices that are volatile and significantly higher than at the turn of the century (UNEP, 2014). This has motivated some countries and businesses to incorporate resource considerations into their growth strategies. In the cement industry, for example, fly-ash blends have replaced over 30 per cent of virgin limestone (Darko et al., 2013).

Findings by IRP (UNEP, 2014) have shown that the decoupling of economic development from environmental degradation occurs when inefficient processes are replaced by new generations of technology. These shifts occur due to, (a) natural maturation of economies, (b) the transfer to overseas locations of resource consumption burdens, or (c) market- or policy-induced increases in resource productivity. Well-functioning economies tend to increase resource productivity by investing in research, which produces steady technological innovation. Infrastructures conducive to high efficiency and low material intensity manufacturing combined with shifts in consumer attitudes and consumption patterns support this transition.

However, earlier studies have shown that policies promoting steep rises in resource productivity face considerable barriers, and businesses and even public services tend to focus more on raising labour productivity. This is because transitions to higher resource productivity may require conservation strategies and investment in natural capital with a longer-than-commercial payback, resulting in a short-term reduction to Gross Domestic Product (GDP) growth, especially in sectors whose natural capital is severely depleted, such as in fisheries[x]. However, economic projections with investment in natural capital suggest that scenarios with higher resource productivity will out-perform "business-as-usual" strategies by 2020, while yielding significantly more environmental and social benefits including jobs (especially in the agriculture, buildings, energy, forestry and transport sectors), land productivity enhancements, and emissions reduction (UNEP, 2011). This is particularly the case for energy production, housing, transport (all of which involve substantial fossil fuel consumption), agriculture, and fisheries, which have been identified by the International Resource Panel as the most important drivers of environmental pressures or that are responsible for the most significant impacts.[5]

The common strategy of outsourcing the burdens of resource and environmental degradation to other countries, as economic structures mature, is not expected to be feasible for much longer. Both because of global resource availability issues and from a public acceptability viewpoint, the number of locations willing to pay the environmental price for others' consumption is rapidly diminishing. For example, the export of meat, crops and flowers involves the use of huge quantities of water, land and nutrients to produce the commodities that are exported (Global Hunger Index, 2012) — a major burden for the resources and environment in these regions that substantially reduce the otherwise significant gains from trade.

Social/human development: Large variations in access to resources between and within countries, and overall limits on the availability of natural resources, reduce the positive benefits that they can deliver for human development. Economic growth, urbanization, and industrialization taking place without due regard for resource and environmental considerations are now putting great pressure on natural resources and the environment and damaging the health and livelihoods of many people who depend on them for their subsistence.

South Asia — already home to more than 44 per cent of the developing world's poor — is one of the most populated and rapidly growing sub-regions and starkly demonstrates environment–development tensions. More than half of this region's population is rural and directly dependent on land-yielding natural biotic resources for their livelihoods, while rapid urbanization magnifies demand for energy and mineral resources that compete for the same land. Food, energy and water insecurities loom and are likely to be exacerbated by climate change. However, development strategies in the region, bridging diverse geographies and economic sectors, provide many examples of resource management synergies at basin, sub-basin, and local scales, indicating the potential for significant constructive solutions. These strategies for inclusive economic growth can alleviate poverty while also strengthening the environmental resource base, through sub-regional trade, the management and sharing of natural resources, and the transformation of current systems of production and distribution to meet sustainability imperatives (SACEP, 2014).

Addressing the challenge of poverty — especially in relation to human health and disaster vulnerability in poor and developing countries — requires multi-dimensional approaches that depend on legal and physical access to natural resources. For example, reducing air pollution requires access to clean energy services to replace traditional biomass and unclean fuels for cooking and transportation, while the degradation of coastal resources has led to the loss of lives and livelihoods in coastal communities (Lim et al., 2013).

Demand for mineral resources to support industrial growth and urbanization must be met either through domestic extraction or through imports from other regions. Both options often result in the displacement of indigenous populations dependent on mineral-rich lands and forests (IGEP, 2013). Higher resource efficiencies, waste recovery and recycling, and closed loop processes — all examples of decoupling strategies — can offer solutions to these problems. However, socio-economic uncertainties, exacerbated by potential future climate change, represent a major obstacle to the development and implementation of these options (IGEP, 2013).

Equity: Average per capita use of resources is hugely disparate in developing and developed countries, ranging from 2 tons/cap/year in the

5 In 2010, the International Resource Panel published the *Assessing the Environmental Impacts of Consumption and Production: Priority Products and Materials*, a scientific assessment report which identified the principal global consumption activities, industrial sectors and materials from primary industries, in terms of their environmental impacts and their resource use.

former to 30-40 tons/cap/year in the latter (UNEP, 2014). Such inequities in the current national and global governance systems mean that growing resource constraints do not affect everyone equally. In the BAU scenario of UNEP's *Green Economy* report, the world's poorest people suffer the greatest opportunity cost in terms of consumption and development, even though they are minor consumers of many of the natural resources and benefit least from the economic activities that generate wealth while passing costs on to the Earth-system (UNEP, 2011).

Historically, resource constraints have always generated questions of equitable access to raw materials and distribution of derivative economic benefits at local, national, and global levels. However, in the current situation of emerging global resource scarcity, significant improvements to both the use efficiency and distributional equity of natural resources are essential for society to converge into a "safe operating space" for the environment while *at the same time* elevating all humanity "above the social floor" (Raworth, 2012). In present circumstances, the need to share available global resources which aims to promote peaceful and inclusive societies and justice for all[xi], is an essential component of SDG strategies.

Local-global contexts and stakeholder interests: Viable resource policies must be based on a thorough understanding of the fundamental but variable role that resources play in diverse economies and at different scales. Solution pathways need to be elaborated which are beneficial and effective simultaneously both on local and global levels and avoid geographic problem shifting.

On the smallest scales, land, water, energy, and material resources may be managed by individual farmers, foresters, fishers, households, or local governments. Most often, small holders need to know how to acquire best management practices, including knowledge and low-cost technologies for efficient and sustainable collection of resources. In this way, individuals and communities can improve their standards of living by treating resources as a permanent asset.

Corporations have a financial interest in improving the material and energy use efficiencies of their production processes. Sustainability best practices and regulations can help them to upgrade and optimize production and distribution systems, improving competitiveness and economic viability, with reduced resource inputs and business risk.

Cities and regions often have governance responsibilities for social policy, waste management, economic activity, and infrastructure construction and management. At these scales well-considered sustainability initiatives and regulations can guide citizen and corporate behaviour toward greater resource use efficiency increasing standards of living while minimising the environmental impact of growing conurbations.[6]

At still larger geographical scales, tools and institutions including national laws and international commitments must find a balance between resource demands and planetary boundaries. Major drivers of resource extraction are the interests of large private and public stakeholders, which include the security and growth of resource supply, and enhanced international competitiveness. Overall demand for these resources is driven by economic growth, fuelled by international trade, and the domestic production and consumption of all countries. In this dynamic and competitive context, national resource conservation strategies need to seek to anticipate and ensure the long-term viability and sustainability of resources, ecosystems, and standards of living.

6 Scientific assessment work under the scope of the International Resource Panel's cities workstream provides examples of innovative approaches to urbanization and infrastructure that can significantly reduce resource consumption in cities. Following the publication of the 2013 report on *City-Level Decoupling: Urban Resource Flows And The Governance Of Infrastructure Transitions*, the Panel is now looking at the resource requirements of future urbanization.

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Seeking Synergies, Avoiding Trade-Offs

The SDG framework provides an opportunity to transform the international debate about sustainable development and take it beyond the usual question of trade-offs between environment and development. Strong links between various goals and targets provide opportunities for co-benefits and other synergies between different Goals, while the need to make progress on all the SDGs together offers an opportunity to avoid the all-too-common experience of "sacrificing" one desirable outcome to reach another.

Synergies are particularly visible in the domains of resource conservation, ecosystem restoration, resource efficiency of use, and waste reduction. Progress on any of these goals can push the others forward and generate momentum for the decoupling of development from both resource consumption and environmental degradation.

Modernization, and expansion of clean technologies, can also reconcile equitable resource distribution with environmental restoration and resilience-building measures. Closing agricultural yield gaps in Sub-Saharan Africa, for example, can build self-reliance in food-importing countries, and even transform them into exporters, giving former subsistence farmers an income while, if well planned, avoiding deforestation and other land use change.

Different Policy Response Scenarios on Individual and Clusters of SDGs

Research done at IIASA (Obersteiner et al., 2015) has examined the tensions created by competition for resources between food security and environmental conservation to identify some of the more difficult trade-offs that will be faced in the pursuit of multiple SDGs. Restricting land use change can mitigate deforestation and associated greenhouse gas (GHG) emissions, habitat destruction and biodiversity loss, and reduce reliance on fertilizers. But these policies can also end up limiting the land available for agriculture and reducing crop production, resulting in expansion of irrigation, decreased availability of food and increased food prices.

Strong restrictions on land use change[7], therefore, support natural resource conservation, but require additional parallel investments in resilient and productive agricultural systems to maintain food security. Such studies, by identifying complex interdependencies, allow general conclusions to be drawn about how to avoid zero-sum outcomes in which policies designed to achieve one SDG jeopardize the attainment of others. Coherent mixes of policies are often needed for positive net environmental and development outcomes in complex situations. Based on its analysis of such resource nexus issues, Obersteiner et al. (2015) classifies policy strategies for SDG implementation into three groups:

The ***first*** set of strategies increases pressure on land and human systems, resulting in a net deterioration of progress toward SDGs as an integrated whole. In many cases, policies designed to target a subset of the SDGs result in a disproportionate increase in the challenges facing other sectors, putting some SDGs further out of reach. Because they significantly reduce resource availability, many aggressive environmental conservation initiatives fall in this category, as do silo approaches in which individual issues are carved from the whole and pursued as if in a vacuum. Strategies limited to a series of interventions targeted at single SDGs may forestall growing challenges in some sectors, but will fail to provide comprehensive, lasting solutions. In the example in the Obersteiner et al. (2015) study, ambitious bio-energy production and biodiversity conservation measures impose costs on food, feed and fibre production systems, compromising food security in the short-term and the feasibility of additional conservation initiatives in the long-term.

The ***second*** class of strategies includes those which neither increase nor reduce the pressure on land resources. Policy options in this category do not avoid trade-offs among sectors and goals, but they do allow for prioritization among goals and targets, buttressing systems in danger of failing without increasing disproportionately the burden on other sectors. Environmental policies like GHG pricing and forest conservation measures have minimal pressurizing effect on land systems, and therefore, need to be pursued as first steps toward broader SDG implementation.

The ***third*** set of strategies reduces pressure on the land system, largely through the adoption of Sustainable Consumption and Production (SCP) programmes. This set escapes zero-sum outcomes and achieves net positive progress toward the SDGs as a whole by identifying effective regional policies that collaboratively satisfy the larger outcomes of SDGs. For instance, dietary shifts in developed regions away from meat and animal products, which are land- and water-intensive commodities, can reduce mortality and other health impacts and costs from over-consumption. At the same time, this will increase the availability of calorie and protein sources in developing countries, reducing mortality and enabling progress toward food security for all (Goal 2).

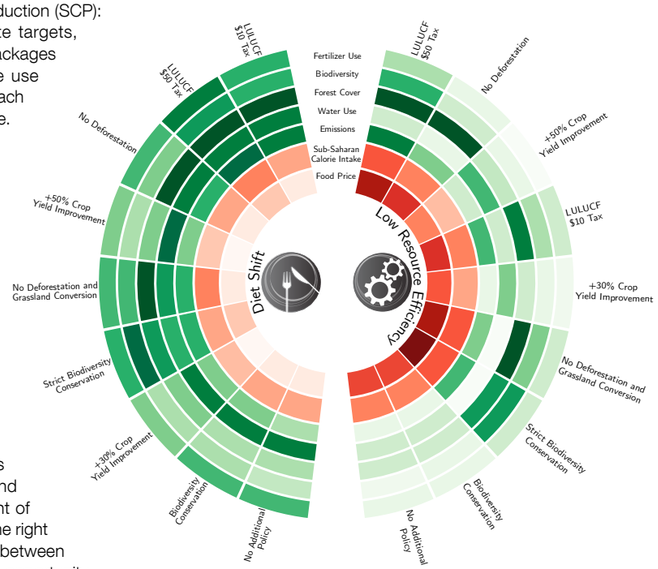
Figure 2: Environmental and Food Security impacts of different policy mixes

Each radial wedge of this circular plot presents the simulated results of a specific SDG policy package. In the left hemisphere, all packages include policies chosen as examples of sustainable consumption and production (SCP): reduced Western meat consumption & sub-2°C climate targets, allowing for nuclear energy. In the right hemisphere, all packages include the following non-SCP strategies: low resource use efficiency & sub-2°C, without nuclear energy. Additionally, each wedge contains the policy listed on the outer circumference.

Each ring in this plot presents the performance of policy packages as measured by two food security and five environmental indicators (globally aggregated, except where noted): food prices, Sub-Saharan calorie intake, LULUCF GHG emissions, agricultural water use, forest cover, biodiversity, and fertiliser use. For environmental indicators, darker green shading signifies superior environmental outcomes, while darker red shading corresponds to degraded food security.

Policy combination wedges in each hemisphere are ranked vertically according their combined performance over all seven indicators.

In aggregate, comparison of the two hemispheres demonstrates the necessity of sustainable consumption and production (SCP) measures for simultaneous achievement of food security and environmental sustainability. Relative to the right (non-SCP) hemisphere, SCP policies minimise trade-offs between food and environment, indicating that SCP measures are an opportunity to decouple development from environmental degradation and to escape zero-sum outcomes. This approach is less likely to create global winners and losers, suggesting a path toward an equitable future that raises all peoples above the developmental "floor" while keeping society under the environmental "ceiling".



7 The International Resource Panel scientific assessment report on *Assessing Global Land Use: Balancing Consumption with Sustainable Supply* was published in 2014. It explores how the management of land-based biomass production and consumption can be developed towards a higher degree of sustainability across different scales: from the sustainable management of soils on the field to the sustainable management of global land use as a whole.

Strategies to Reduce Pressures on the Natural Resources System and Develop Synergies

This third class of strategies highlights the benefits of resource-conscious development, backed by strong economic and social drivers that make it attractive economically and socially to incorporate conservation, efficiency and productivity concerns in local, national, and corporate policies. The transition to clean fuels, for example, can significantly benefit human health and well-being and also reduce pressures on forests and fossil resources, again indicating positive links between goals on health, poverty, ecosystem health and climate change (Lim et al., 2013). This section outlines a number of these strategies, which, by exploiting synergies among the Sustainable Development Goals and targets, can achieve desirable development outcomes and decrease the vulnerability of societies and economies to global change.

Sustainable Consumption and Production (SCP): The concepts and practices that fall under SCP are one such set of strategies to avoid zero sum outcomes and resolve the developmental and environmental challenges articulated in the SDGs. "The concept of SCP links economic processes to the environment and natural resources and provides policy instruments and tools to encourage cleaner production and responsible consumption." (UNEP, 2012; Norway Ministry of Environment, 1994)12. SCP strategies are designed to ensure that, (a) multiple SDGs are attainable simultaneously, (b) policy measures are implemented effectively in a multi-objective environment and, (c) problem shifting is minimised.

Policy actions to move towards SCP will need to achieve most if not all of the following outcomes: radical decoupling between economic growth, and overall resource use and environmental impacts, as described further below; enormous increases in resource productivity especially in respect of land and water; and lifestyle shifts away from land- and GHG-intensive activities. To the extent that any of these changes are not achieved, the others will have to be achieved to a greater extent (e.g. growth in meat-eating to current developed country per capita levels will require far greater increases in the productivity of land than if such growth were moderated, and developed countries began to reduce meat consumption). The policies that are required to achieve these SCP outcomes are well understood, and have already been widely implemented in different countries, albeit not yet with the required stringency.

SCP strategies thus entail reducing pressures on the natural resource system by increasing efficiency, decreasing pollution (sustainable production), and reducing resource demand and waste (sustainable consumption). These strategies recognise that keeping within the boundary constraints of the Earth System is a necessary condition for equitable and sustainable human well-being and prosperity. Their aim is to reduce environmental impacts and resource depletion by managing resources more efficiently, enabling countries to achieve their social goals without undermining the basis of human development (UNEP, 2014). SCP has been accorded high priority in the SDG framework: Goal 12 is entirely devoted to it, and the 10 Year Framework of Programmes (10YFP) recognised SCP as the primary international mechanism to drive the achievement of the SDGs. However, despite being an explicit global objective at least since the Earth Summit in 1992, SCP has so far proved an elusive goal.

Decoupling Natural Resources from Economic Growth: SCP strategies seek to ensure that more value is generated from less use of resources. The International Resource Panel (IRP) has applied the concept of 'decoupling'[xiii], which requires a reduction in the growth of resource use relative to total economic productivity, to the challenge of building a more sustainable global economy.

Relative decoupling occurs when economic output grows faster than resource use and/or environmental degradation. This is the situation to be expected in low-income countries, as they build their infrastructure and productive capacity with efficient use of resources and using clean technologies, thereby increasing the wealth, health and well-being of their citizens. Given that at the global level, resource consumption is already pressing up against the constraints of the Earth system, if developing countries are to have environmental space to grow, then for developed countries "decoupling GDP from resource use is, by definition, an absolute essential – a logical necessity" (Gower et al., 2012). To achieve holistic, sustainable development, both resource use and environmental degradation must be decoupled in absolute terms from economic growth throughout the developed world.

UN member states have acknowledged[xiv] that SCP prescriptions will be critical for decoupling resource use from economic growth (resource decoupling) and environment degradation (impact decoupling). However, decoupling concepts are not strongly reaffirmed in the targets. Technical refinement of targets (as suggested in the UN Secretary-General's report of December 2014) and more importantly quantification of specific indicators in terms of the degree of decoupling to be achieved is essential[xv]. Specific targets will foster clarity with regard to the technological, financial, and social investments that are required to achieve benchmarks by different dates in each country. The Sustainable Development Solutions Network has called for a Global Partnership for Sustainable Development Data to bring about a 'data revolution' so that such clarity of intent can be achieved (SDSN 2015).

Circular Models: New developments in regenerative models of production and consumption emerging from recent innovations in both technology and business models promise to enhance resource productivity to new levels, as economies move away from the current linear 'take-make-dispose' model of value chains towards more circular economy models. In these models, products are reused as many times as possible in various sectors before finally being returned safely and, for biowastes, productively to the biosphere. This maximises the value derived from each unit of resource consumed in lifecycle of the product. Inspired by the closed loop processes of natural systems, these circular models look to transform resource consumption to resource use (consumers to users) and resource stewardship. Where they have been established, the direct benefits of closed loop production and consumption cycles include substantial reductions in GHG emissions and virgin resource use. Directly and indirectly, they create significant numbers of jobs; generate financial savings through techniques such as reusing, recycling and remanufacturing[8]; and increase use of renewable energies.

Historically, the traditional reuse–recycle behaviours of consumers in poor countries have been overtaken by 'take-use-dispose' behaviours as incomes and modern production methods and market systems grow. Circular models have the potential to prevent or slow down such destructive transitions by integrating recycling and resource reuse into new production chains as they are established (Lehmann, H; Rajan, S.C, et al. 2015).

Shifts towards circular systems represent transformational opportunities for resilient growth in developed countries. In developing

8 The International Resource Panel is initiating a new scientific assessment on the resource and energy saving potentials of product life cycle extension activities such as Remanufacturing, Refurbishment, and Repair in the context of the Circular Economy.

countries, they can foster rapid transitions to more sustainable, efficient and secure futures that avoid the wasteful habits and destructive mistakes of developed countries (Ellen MacArthur Foundation, 2013, 2014)

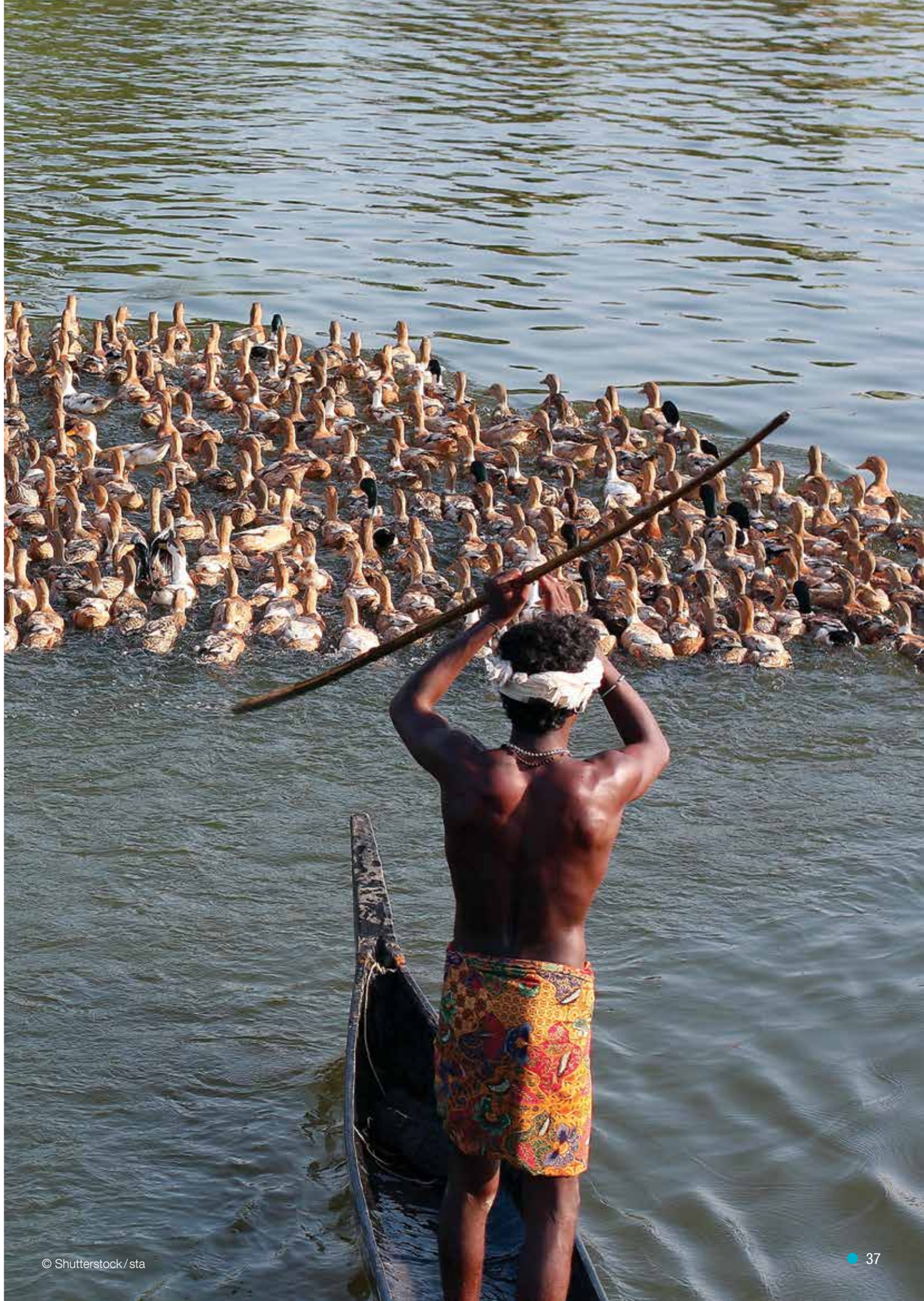
The Need for Common-but-Differentiated Approaches

Avoiding trade-offs and exploiting synergies will require a significant change in policies, technologies and consumption habits at global, national and local levels. Despite varied resource availability, development, and other immediate national concerns, resource management is a policy imperative for all countries. However, it will need to be applied in different ways in different places for an overall net positive outcome. As mentioned above, developed nations have to make a speedy transition towards absolute decoupling of resources from economic growth in order to maintain the same quality of life. Emerging economies need to reorient their development paths towards ever-higher decoupling over a somewhat longer but well-defined period, so as to maintain their competitiveness. For developing countries, their global commitments under the SDG framework offer an opportunity to fast-track development goals by learning from and avoiding the unsustainable pathways adopted by developed nations.

Low-income countries will need to be supported through international cooperation on capacity-building technology and investment so that they can move along a relative decoupling path, enabling their GDPs to grow faster than resource use. Resource decoupling will need to be accompanied by impact decoupling with technology innovation and investments directed towards this end in both developed and emerging economies, as well as incorporated in actions of multi-national corporations in countries whose economies are currently largely dependent on resource exports.

Investment and innovation involving businesses and innovators with policymakers, implementers and communities, should enable less-developed economies to leap-frog the linear economic growth processes of the past to reach the regenerative models of development appropriate for the future.

Finally, the transformation process needs to be underpinned by greatly increased information and knowledge about the current state of resources, leading to much higher awareness the risks of conflicts and mass migration to which this is leading. Yet many developing countries face stringent limitations on the gathering of information about their resources and environments due to the absence or weakness of bodies responsible for collecting statistical data. Deficiencies in this area hinder understanding of challenges faced. Comprehensive support to improve the quality of data collection and the creation of decision support tools appropriate for developing countries, as part of the SDG process, will help build more reliable information for national and international policy planning[xvi].



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In Conclusion

The Sustainable Development Goals offer a unique opportunity to move beyond the limited and somewhat asymmetric agenda of the Millennium Development Goals (MDGs) to an integrated, universally relevant and potentially transformative Global Development Agenda. The core essence of the SDGs is human well-being: sustained prosperity for all within planetary limits.

There is evidence from a number of countries and businesses that pursuing an aggressive SCP agenda need not impact negatively on competitiveness and economic growth. In the context of the 10YFP, UNEP has documented a wide range of case studies in which decisive moves towards SCP have contributed to poverty eradication, increased productivity and competitiveness, and climate change mitigation (UNEP, 2015). The New Climate Economy Report even suggests that the innovation and new technologies from addressing climate change may even initiate a new growth cycle (NCE, 2014).

If such potential developments represent the opportunity of embracing the SCP agenda, not doing so will expose the global community to considerable threats. What is very likely is that failing to move decisively towards SCP will result in a continuation of the established trade off pattern between the SDG objectives, at the expense of sustainable resource use and the environment, such that resource constraints and environmental changes result in even the social and economic SDGs not being attained in the medium- to long-term, and undoing much development that has been so painstakingly achieved in recent decades.

The policy-makers who endorse the SDGs need to appreciate the historic challenge that they represent and commit themselves to a new era of policy making that relentlessly promotes SCP as an integral part of coordinated SDG policy packages: radical decoupling between economic growth, resource use and environmental impacts; enormous increases in resource productivity, especially that of land and water; and lifestyle shifts away from land- and carbon-intensive activities. Integrated strategies that incorporate transformations in production systems and in the consumption of services derived from natural resources will be necessary across all nations. Policy strategies will need to balance short- and medium-term socio-economic gains with longer-term benefits of sustained human prosperity within a healthy natural ecosystem.

In brief, the fulfilment of the SDGs in word and spirit will require fundamental shifts in the manner with which humanity views the natural environment in relation to human development, and acts upon it.

End Notes

i. Social floors are nationally defined sets of basic social security guarantees that ensure, as a minimum that, over the life cycle, all in need have access to essential health care and to basic income security which together secure effective access to goods and services defined as necessary at the national level.

ii. The environmental ceiling consists of nine planetary boundaries, as set out by Steffen et al., 2015, beyond which lie unacceptable environmental degradation and potential tipping points in Earth-systems.

iii. *12 of the 169 Targets indicate "ending" conditions* of poverty and vulnerabilities with respect to hunger, malnutrition, open defecation, disease, violence and social discrimination against women and other vulnerable groups; 18 of the targets refer to "access to all" for education, economic opportunities, clean energy, safe water, housing, social support and legal recourse services etc.; 11 targets refer to "increasing the engagement" of poor and vulnerable through participation in decision making, economic processes, in education, access to information; while 8 of the targets look for "reduction to a substantial degree" the levels of poverty and numbers of poor and vulnerable and their exposure to climate shocks, disaster impacts and other vulnerabilities (Raworth, 2012). Around 17 of these targets are quantified, making for better monitoring and track ability.

iv. Drawn on the analysis from Cutter, A et al. (2015), Sustainable Development Goals and Integration: Achieving a Better Balance Between the Economic, Social and Environmental Dimensions, Stakeholder Forum; Bringezu, S. (2015), Some Strategic Considerations on the Work of the IRP Towards the Implementation of SDGs;Le Blanc, D. (2015), Towards Integration at Last?; and United Nations Environment Programme (UNEP) (2015), Sustainable Consumption and Production Indicators for the Future SDGs, UNEP Discussion Paper, March 2015.

v. Prudent use of natural resources are especially critical for the fulfilment of SDGs# 1, 2, 3, 4, 5, 6, 8, 9, 10, 11 and 13 plus #16 which relates to fostering peaceful societies. Studies indicate that peace is contingent in large measure to resource scarcities and inequities in distribution.

vi. The reciprocal relationships identified, for example, between target 8.4 (that explicitly advocates for decoupling resources from economic growth) and targets 12.2, 14.7 and 14.a point to the need for strategies necessary for both maintaining a healthy resource base and a sustained economic growth. Similarly, targets 15.1 and 6.6 connect the fulfilment of safe water and sanitation for all with the protection and restoration of water related ecosystems (Cutter et al., 2015).

vii. However, resource consumption patterns have shown to have a greater impact on resource stress than growing populations. Countries with booming population, especially the developing countries, have in fact lesser resource consumption than developed countries. Therefore directing consumption towards sustainable patterns is necessary.

viii. The strong interlinkages that exist between human well-being and ecosystem health, for example of food-energy-water-climate, presents us with a possibility that sudden collapse of an Earth-system such as the marine ecosystem and fisheries if put under too much stress, could impact food security in many nations. (WBCSD, 2012)

ix. This is an active area of research and even though this approach does not offer a complete roadmap for sustainable development, the insights it generates can enable governments to make informed decisions regarding policy strategies for forwarding the objectives of human development without causing irreparable damage to the environment.

x. In fisheries, the prioritization of conservation strategies may result in the loss of jobs and income in the short- to medium-term, in order to replenish natural stocks that will allow the industry to rebuild.

xi. There is increasing evidence of domestic as well as international conflicts due to resource scarcities, climate impacts and pollution. Development scientists have found that resource surpluses too can lead to conflicts as the allure of big profits increase the likelihood of resource control and violence (Gies, 2011; Homer-Dixon, 1994; Maxwell & Reuveny, 2000).

xii. The original definition of sustainable consumption was developed during the Oslo Symposium on Sustainable Consumption in 1994.

xiii. Decoupling simply means using fewer resources per unit of economic output and reducing the environmental impact of any resources that are used or economic activities that are undertaken.

xiv. As reflected in the 7th session of the UNGA https://sustainabledevelopment.un.org/owg7.html

xv. For example, Goal 6 on sustainable water and sanitation for all, with related targets 6.3, 6.4 and 6.6 could put a 'benchmark' for "water use efficiency" to be achieved to enable water security for all and "benchmarks of health of water related ecosystems" to be restored.

xvi. The five priorities recently recommended by the International Council of Science (ICSU) are relevant here: devise metrics, establish monitoring mechanisms, evaluate progress, enhance infrastructure, and standardize and verify data (Lu et al. 2015). Many countries will need assistance in responding to these recommendations in a scientifically robust way.

Annexes

The Background Research

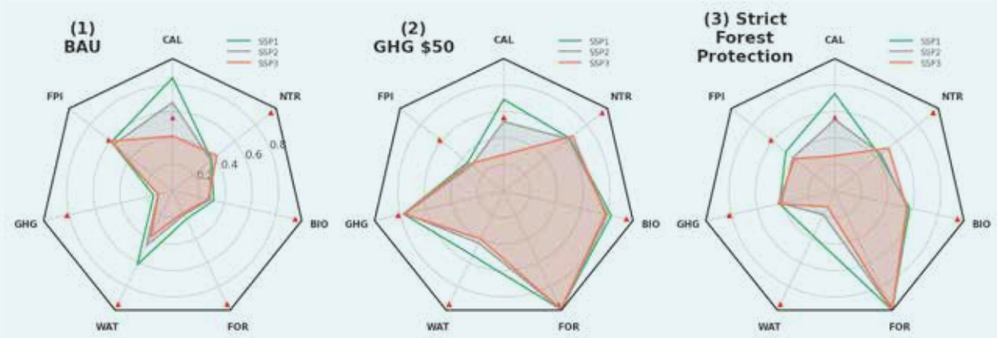
The analysis of the relationship between the SDGs is based on the work of expert member of the International Resource Panel, Michael Obersteiner, and his team at the International Institute for Applied Systems Analysis (IIASA), which is presented in more detail in *Obersteiner, M. et al., (2015), Assessing the Resource Nexus of the Sustainable Development Goals, IIASA*.

The Methodology

In this analysis, qualitative SDGs and their component targets are translated into a range of potential *policies*, defined as discrete shifts from business-as-usual (BAU) undertaken on a global scale in service of individual environmental or developmental targets or subsets of targets. Policies are grouped into *policy domains* according to the resources and SDG target(s) they affect most directly. Each policy domain includes *active policies*, which reflect a particular degree of ambition vis-à-vis relevant environmental or developmental target(s), and a *null policy*, which projects inaction on the same targets.

Policies are combined into *strategies*, defined as any and all policies enacted on a global scale in service of any SDG targets. Business-as-usual (BAU) represents a *null strategy*, or a future in which zero active policies are enacted. Single-policy strategies are comprised of exactly one active policy from one policy domain and the null policy in the remaining policy domains, and so on for multi-policy strategies.

With this construction, we use GLOBIOM to model the implementation of single- and multi-policy strategies. By studying the transfer of pressure among renewable resource cycles and food production systems, we identify the direct and indirect consequences of SDG strategies. We synthese these dynamics into a multi-sectorial assessment with a focus on linkages and interdependencies between environmental initiatives and food security and among individual SDGs in the land system.



Seven pressure indicators (global food prices (FPI), calorie consumption *per cap*. in Sub-Saharan Africa (CAL), fertiliser use (NTR), biodiversity loss (BIO), deforestation (FOR), agricultural irrigation (WAT), greenhouse gas emissions (GHG)) are used to measure the consequences of SDG strategies. Results are normalized between 0 (worst outcomes) and 1 (best outcomes) and plotted on the radial axes of these radar charts. For example, the following single-policy strategies are projected through 2030 in three socio-economic development scenarios: (1) BAU, (2) greenhouse gas pricing ($50 USD(2000)/ton$C_{eq}$), and (3) strict forest protection. The red triangles on each radial axis correspond to a target value for the indicators (year 2000 value for all except CAL; 2000 calories/cap/day for CAL), and the total area of each polygon is proportional to its success as a SDG strategy. Trade-offs and co-benefits can be seen by comparing strategies' performance on each indicator to BAU and to each other.

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About the Document

About this Paper

This paper from the International Resource Panel (IRP), developed with support from Development Alternatives and the International Institute for Applied Systems Analysis (IIASA), draws upon recent research from the IRP and analysis from IIASA highlighting the impact that pressures on the limited resource base may have on comprehensively fulfilling the aspirational and ambitious SDGS. It brings forth the need for an understanding of the nexus between components of the natural resource system and the natural and socio-economic ecosystems to identify the environment-development trade-offs envisaged in the implementation of the post-2015 global sustainable development agenda. These trade-offs can only be resolved if sustainable development policy strategies are coordinated and coherent across goals in the Sustainable Development Goal framework. The paper advocates that increased efficiencies of resource use in production systems along with reduction of wastes and unnecessary consumptive patterns (SCP) are necessary for sustainable development. And, that decoupling of economic activities from the use of natural resources and the impacts of use is a key SCP strategy for the success of the Global Sustainable Development Agenda. However, the report cautions that decoupling strategies would have to be applied differentially by developing and developed countries in context of resource distribution, priority needs of nations and stakeholder interests.

The Background Research

The IIASA research looks at the land resource nexus of the SDGs and the difficult trade-offs that will likely have to be made. Using an economic impact assessment model to evaluate quantitatively the consequences of a range of focused policies targeting specific SDGs (i.e. biodiversity and forest conservation, bio-fuel production, GHG pricing, dietary shifts, and agricultural resilience, yields, and waste levels) on the achievement of other goals relating to the land system, the study highlights the probability of competition leading to a zero-sum outcomes in which policies aimed at achieving one goal could directly degrade dimensions of other SDGs. As a result, piecemeal approaches to SDG implementation could create policy incoherence to the detriment of environmental and developmental outcomes. Results suggest that it is possible for carefully designed sets of policies to manage inevitable trade-offs in a way that avoids zero sum outcomes and generates synergies for multiple SDGs[9].

9 Obersteiner et al. (2015), Assessing the Resource Nexus of the Sustainable Development Goals.

About UNEP-IRP

The UNEP-hosted International Resource Panel (IRP) was established in 2007 to provide independent, coherent and authoritative scientific assessments on the use of natural resources and its environmental impacts over the full life cycle and to contribute to a better understanding of how to decouple economic growth from environmental degradation. The Panel is constituted of eminent experts from all parts of the world, bringing their multidisciplinary expertise to address resource management issues. Benefitting also from the support of a large number of governments and other stakeholders, it provides a platform for exchange between policy-makers and scientists so that policies for sustainable development can be formulated taking into account the best available science. The assessments of the IRP to date demonstrate the numerous opportunities for governments and businesses to work together at the science-policy interface to create and implement policies to encourage sustainable resource management, including through better planning, more investment, technological innovation and strategic incentives.www.unep.org/resourcepanel

About IIASA

Founded in 1972, IIASA is an international scientific institute that conducts policy-oriented research into problems that are too large or too complex to be solved by a single country or academic discipline. Problems like climate change that have a global reach and can be resolved only by international cooperative action. Or problems of common concern to many countries that need to be addressed at both the national and international level, such as energy security, population aging, and sustainable development. Funded by scientific institutions in the Americas, Europe, Asia, Oceania, and Africa, IIASA is independent and unconstrained by political or national self-interest. www.iiasa.ac.at

About Development Alternatives

Development Alternatives (DA) is a premier social enterprise with a global presence in the fields of green economic development, social equity and environmental management. It is credited with numerous technology and delivery system innovations that help create sustainable livelihoods in the developing world. DA focuses on empowering communities through strengthening people's institutions and facilitating their access to basic needs; enabling economic opportunities through skill development for green jobs and enterprise creation; and promoting low carbon pathways for development through natural resource management models and clean technology solutions.www.devalt.org