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The road to sustainability must bridge three great divides

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The world's large and rapidly growing human population is exhausting Earth's natural capital at ever-faster rates, and yet appears mostly oblivious to the fact that these resources are limited. This is dangerous for our well-being and perhaps for our survival, as documented by numerous studies over many years. Why are we not moving instead toward sustainable levels of use? We argue here that this disconnection between our knowledge and our actions is largely caused by three "great divides": an ideological divide between economists and ecologists; an economic development divide between the rich and the poor; and an information divide, which obstructs communications between scientists, public opinion, and policy makers. These divides prevent our economies from responding effectively to urgent signals of environmental and ecological stress. The restoration of natural capital (RNC) can be an important strategy in bridging all of these divides. RNC projects and programs make explicit the multiple and mutually reinforcing linkages between environmental and economic well-being, while opening up a promising policy road in the search for a sustainable and desirable future for global society. The bridge-building capacity of RNC derives from its double focus: on the ecological restoration of degraded, overexploited natural ecosystems, and on the full socio-economic and ecological interface between people and their environments.

Keywords: ecological economics; ecological restoration; economic divide; ideological divide; information divide; maintaining biodiversity; restoring natural capital

Introduction

Humanity is depleting Earth's limited stocks of natural capital faster than they can regenerate,[1] indicating an impending global resource crisis of unprecedented scale. The relevant data have been accumulating for decades and are freely available,[2,3] but they have had little meaningful, concrete, and decisive impact on policy making to date. Most modern societies continue to build and dream on the basis of an unrealistic notion of perpetual economic growth. This deeply flawed perception spells ultimate societal collapse when unfettered and accelerating consumption hits the wall of scarcity as

finite biological resources and services are exhausted. This can only be avoided if we learn how to live more sustainably. Instead of diminishing natural capital stocks, we should be living only off the "interest"—the ecosystem services—which those stocks generate. We should therefore be investing much more heavily in maintaining (conserving) and augmenting (restoring) our natural capital stocks to "grow" more ecosystem services.

The current worldwide financial crisis offers an excellent opportunity for decision makers to reevaluate our direction, to shake off dogmas that fail to reflect our economic and environmental realities, and to make a new commitment to overcome the divides and barriers that hamper our collective progress toward sustainability. The socio-ecological challenges our human-dominated planet is facing should urge us to reorient our economic, social, and communication policies in this direction. Constraints on consumption in economically rich countries and a rapid stabilization of population (and per capita demand) worldwide must be elements of any "solution." This is common sense, yet our societies seem to be incapable of moving toward its implementation within the immediate future. What is required, therefore, is a strategy to guide global, national, and local actions that will galvanize and focus public opinion, create collective learning experiences to develop social capital, and provide models for global cooperation toward sustainability.

We argue that the mainstreaming of the restoration of natural capital (RNC) is a practical and powerful means to augment natural capital, but also, and crucially, to overcome social, cultural, and political obstacles to the implementation of sustainability policy. This is because RNC thinking always links environmental issues to social and intergenerational justice.

In this article we identify three "divides" that must be bridged if global economic sustainability and social justice are ever to prevail. These are: the *ideological divide* that impedes communication between different disciplines, such as economics and ecology; the *economic development divide* that represents the growing chasm between the (financially) poor and the rich; and the *information divide* between the data at our disposal about natural capital depletion and the response to those data by those in decision-making positions. Each of these interrelated divides currently obstructs attempts to replace our current profligacy with economic and environmental prudence.[4] All three will have to be overcome if we are to be successful in the quest for sustainability.

Before discussing these divides in detail, and how restoration projects and programs could assist and contribute in overcoming them, we first need to define some basic terms.

Definition of terms

The term "capital" refers to any stock that yields a flow of goods in the future.[5] Natural capital, which is an economic metaphor for the limited stocks of physical and biological natural resources found on Earth,[6,7] is one of the five principal forms of capital,[2,8] and unlike the other kinds of capital, there are no adequate substitutes for it. Four basic forms of natural capital were recognized by the Millennium Ecosystem Assessment[2]:

(1) Nonrenewable natural capital (extractable assets, e.g., petroleum, coal, iron ore, diamonds, etc.);
(2) Replenishable natural capital (e.g., the atmosphere, potable water, fertile soils);
(3) Cultivated natural capital (or production systems, e.g., crops, forest plantations, and fish and crustacean farms, all of which constitute ecosystems engineered and managed by people for the production of goods); and
(4) Renewable natural capital (ecosystems, their biodiversity, and their regulating functions of economic import, such as the regulation of climate).

Replenishable, cultivated, and renewable natural capital all provide flows of ecosystem services essential to life and economic production.[2,3,9–11] Natural capital is, therefore, quite literally, fundamental to our economies. However, with the exception of cultivated natural capital, it is currently undervalued, and sometimes even invisible, in our national and international systems of economic analysis and in indicators like gross domestic product.[12–15] Thus, for the most part, economists, planners, and policy makers have failed to note that the human use of ecosystem services has surpassed its annual rate of production over the past two decades.[1] We are ignoring the fact that global society is making withdrawals of natural capital far in excess of its interest rate (ecosystem services) and societal

reinvestments therein. This myopia is heavily influenced by the false assumptions that natural capital stocks are infinite and that technology will always provide substitutes. We make these withdrawals in the name of economic "growth," defined as the ever-increasing flow of matter and energy from ecosystems, into and through economies, where they generate economic benefits for people, and then return to ecosystems as waste.[5] Ironically, the outcome is tending not toward growth but toward depletion and, ultimately, the collapse of ecosystem functions and all economic activities that ultimately depend on ecosystems. RNC is, we argue, an effective way to mitigate the impact of this "ecological overshoot" and, eventually, adapt to the reality that we are living within a socio-ecological system with finite resources.

The concept of RNC derives from a fusion of ecological economics and restoration ecology, the science which theorizes the practice of ecological restoration. Ecological restoration is defined by the Society for Ecological Restoration International as "the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed" (p. 3).[16] RNC is a broader concept[17,18] that refers to all investments in renewable and cultivated natural capital stocks and their maintenance in ways that improve the functions of both natural and human-managed ecosystems, while contributing to the socio-economic well-being of people. Here we will use "restoration" in its RNC sense, where it is always linked to economic well-being.

RNC is like putting money in a failsafe bank, indefinitely generating interest in terms of ecosystem services for as long as it is being managed prudently. Moreover, the economic valuation of natural capital and ecosystem services needs to take account of their true contribution to human welfare and of their increasing scarcity over time.[19] Conventionally, if ecosystem services are valued at all, they are equated to manufactured capital, the value of which depreciates over time. This conventional equation is, we contend, erroneous.[20] The continued application of the conventional valuation methods will have serious negative consequences by further stimulating overexploitation and conversion of natural ecosystems (i.e., capital, such as forests and mangroves) for short-term gains (e.g., palm-oil and edible shrimps), which is currently costing at least US$250 billion per year in terms of environmental damages.[21] Unlike most manufactured capital, the value of natural capital can *appreciate* rapidly, if managed sustainably. Ecosystems provide services indefinitely and accumulate capital over time; but if our account at the "natural capital bank" is overdrawn, increasing scarcity causes the per-unit value of natural capital to rise—especially for so-called critical natural capital, defined as those resources provided by nature that are essential human welfare and for which no adequate substitutes exist.[22–24] Rather than regarding overuse of renewable natural capital as an hourglass running out of sand, we can view it as an impairment of the global ecosystems' capacity to generate new capital. There are, however, three serious obstacles, or "divides," to advancing this restoration process. Our failure to recognize the gravity of current environmental problems and to act effectively to resolve them can be attributed in large part to the three "great divides" briefly defined in the Introduction. Let us now discuss each of them in some detail.

The ideological divide

Ideology is a problematic word with multiple definitions. Here we use it in the sense of a set of established beliefs and values, held consciously or unconsciously by individuals and social groups, which preclude open scientific debate and the emergence of ideas that challenge those beliefs and values.[25] The climate change debate is a good example of how divisive ideology, in this sense, can be. A recent Rasmussen poll found that in the United States, 57% of Democrats blame climate change on human activity, while only 21% of Republicans do so.[26] An earlier Pew survey found that college-educated Republicans are significantly *less* likely (19%) to believe that climate change is human-caused than Republicans without a college degree (31%), suggesting that education alone will not bridge this divide.[27] And we must not forget that, in all too many cases, the willingness of Democrats to embrace the anthropogenic climate change hypothesis may also be determined more by their ideological instincts than by any firm grasp of the scientific debate.

Economists and ecologists likewise appear to exhibit a pronounced ideological divide concerning environmental problems[28]; even among the general public, support for free-market ideology correlates with the belief that climate change is not

anthropogenically generated.[29] A major source of the divide stems from the way in which many—but not all—mainstream economists use utility theory, cost-benefit analysis, and time-discounting,[30] as well as their belief that human-made capital can substitute for natural capital in all cases and without any limits.[28]

According to neoclassical economics, human needs are satisfied solely in terms of individual self-interest and the maximization of utility. Profit and consumption serve as measurable proxies for the abstract concept of utility, treating land, and natural capital under the *ceteris paribus* assumption. This implies that quantitative or qualitative changes in natural resources from human use or impact are not a problem because manufactured capital will provide substitutes through technological advance. *De facto*, this assumes natural resources are presumed "infinite."[14,15] Some economists—albeit a minority—do recognize that market failures lead to the destruction of natural capital and slow the development of human-made substitutes.[5,31–34] For example, if information is imperfect, if property rights are poorly defined, or if a resource can not be owned, markets will fail to generate prices that signal scarcity and induce the innovation of technological substitutes. Most economists assume, however, that correcting these flaws will lead to a market equilibrium that balances all costs and benefits, maximizing utility.

There are two fatal flaws in this argument. First, the ecological economic system in which we live today is highly complex, nonlinear, and prone to positive feedback loops, time lags, and surprises. For example, during recent years, we saw rising prices in housing, food, energy, and financial assets lead to an increase in demand and hence higher prices, followed by falling prices leading to falling demand—positive feedback loops incompatible with the general equilibrium theory of market economics. Second, certain forms and components of natural capital—such as uncontaminated air, potable water, fertile soil, and biodiversity—have no substitutes if depleted.

We do not mean to suggest that only economics is warped by ideology. The thinking of ecologists and environmentalists often suffers from ideological predispositions as well. On the other side of the ideological divide lies the cultural idealism for the static preservation of species and natural areas, to the point of even calling for steady-state economics, espoused by various environmental lobby groups and activists, and frequently endorsed by scientists. Socio-ecological systems, however, are not static. Ecosystems are shaped and re-shaped continuously and, in various degrees, by internal and external environmental forces, including—but by no means exclusively due to—human cultural and economic activities. While conservationists traditionally assume that natural areas are static and unchanging, the most advanced ecological theory and empirical evidence has rejected this tightly held cultural belief of stasis in nature since at least the middle of the last century.[18] There can be no argument that existing natural areas comprise natural capital and deserve protection for that reason alone. All native species in these areas, including the rare ones that are the primary focus of conservation biologists and activists, contribute to biodiversity and thus to ecosystem sustainability and also warrant protection on this basis, and on that of the inherent value of all living beings and species. But the persistent failure of many conservation and restoration activists to recognize that nature is in flux at least as much as it is in equilibrium, because of an attachment to the ideology of the preservation of "pristine nature," undermines the effectiveness of their work.

The ideological divide between mainstream economists and ecologists is also deepened by the failure of many ecologists to turn their research into policy—though many could argue, with justice, that they find themselves *de facto* excluded from the policy arena. Many environmental scientists believe that their job is simply to uncover the facts, or "produce knowledge," upon which decision makers will then act.[35,36] Advocacy is seen as tainting the scientific process.[37,38] If we turn a scientific eye to the policy process, however, we see that policies emerge from strategic interpretations of the facts and good story-telling, not simply from sound science.[39,40] For that reason alone, ecologists can not place themselves above the policy fray.

The economic development divide

Economic growth is, for the most part, measured in terms of percentage change in income. That, however, is a far cry from true or full reflection of economic development. In a broader vision, economic development includes aspects of life, such as

literacy, happiness, life expectancy, and the ability and pleasure to enjoy leisure time. The Millennium Development Goals,[41] for example, recognize eight such different categories and parameters that define economic development.[42] While it is possible to distinguish between growth and development, they are also linked. To develop economically requires at least a minimal income. But there is a threshold above which growth no longer adds to development, as defined above.[43–46] From this point on, economic growth leads to the overconsumption of resources, while those who are doing the overconsuming tend to crowd-out the development potential of all others.

The above scenario leads us to the second divide, which is the morally unacceptable chasm separating the world's rich and super-rich from the multitudinous poor, whose per capita consumption is low to abysmally low. While the affluent exploit natural capital beyond its capacity to regenerate ecosystem services, the poor often use less than is necessary for their well-being or even for their survival. This is a consequence of inadequate access to resources.[47] And we can observe a disturbing new dynamic: the wealthy have begun, albeit too slowly and too little, to restore degraded aspects of their own ecosystems, while continuing to draw on the hitherto less exploited natural capital stocks in poor parts of the world, to maintain and increase their already high levels of consumption. So, while prairies are restored in the U.S. Midwest, and forests flourish again in northern Europe, the inhabitants of these regions are complicit in converting distant tropical rainforests into oil-palm plantations for biodiesel fuel for their automobiles.

Meanwhile, the elites in the developing countries strive to emulate the lifestyles of the wealthy, and so they too overdraw from the remaining stocks of natural capital.[3,48] And the very poor often destroy the last remaining stocks which sustain them, literally cutting the ground from under their own feet through overgrazing and slash-and-burn agriculture, simply to survive, because they have been offered no alternative strategy. For as long as the rich seek ways to continue their resource-intensive lifestyles and to use their financial and political strength to do so, we will overexploit the remaining natural capital on Earth, while the basic requirements for life and livelihoods for many will remain unaddressed. This divide reflects and perpetuates a long history of social injustice that is currently being exacerbated by population growth. Protecting natural capital while alleviating poverty and injustice is thus one of the main challenges for the 21st century.[49]

The information divide

In the face of the dramatic increase in our knowledge about the declines in natural capital stocks, in biodiversity and ecosystem services, why don't markets and governments take effective action? After all, the news about climate change and the overexploitation of wild stocks of ocean fish, to name but two of many prominent indicators, has not been new for a long time now.[2,3,50]

The answer primarily involves the information divide that prevents such knowledge feeding back and triggering the policy and policy actions in the global economy which are essential if such declines are to be halted and reversed. Flows of information from the environment back to the economy are generally inadequate. It is also possible that they are deliberately filtered out by powerful economic interests, which stand to lose by appropriate policy responses, but this divide lies deeper than conspiracies or manipulation. It is closely related to the ideological divide since, in some cases, it is not the absence of information that prevents action, but an ideological predisposition against accepting it. But the divide is also due to the failure of those researching the information to present it in ways which economists and policy makers can recognize as translatable into positive strategies that the public will accept.

Again and again, environmentally friendly policies are presented as costly luxuries, or as obscure and elitist concerns, or as being outright antagonistic to the well-being of human beings. And this obstruction to the flow of accurate information is reinforced by the lingering gaps, both in time and space, between economic/environmental actions and economic/environmental consequences. For example, affluent consumers may benefit immediately from the overexploitation of a resource in another region. They may not appreciate, however, and may not care much about, the negative impacts that occur years or decades later and that will be borne by communities with whom they have little or no contact. Mainstreaming the concept of RNC should narrow these gaps, greatly improving information

flows and making it much easier for the general public and policy makers to understand that prudent stewardship of biological resources and our environment and biosphere in general is a vital factor for longer-term economic success for global society. This knowledge will enable people to see that investment in the environment is ultimately investment in our own collective future and well-being. We will expand on this theme in the next section dealing with the way in which RNC can address these divides.

Bridging the three divides

As mentioned in the Introduction, a suite of actions, such as the reduction of consumption and the stabilization of population growth, are required to enter an era of sustainability. While such changes are essential, they are unlikely to occur in the short run, and so we argue that RNC becomes an important learning ground where the divides can be overcome in practice in specific contexts. This in turn provides positive examples that will assist steering the global economy to sustainability. RNC is therefore a very important and practical strategy toward achieving sustainability, though success will ultimately require a broader range of approaches.

It should be noted that while exceptions are possible, by and large, RNC projects are based on the principles of ecological economics[5] and, ultimately, the values of intergenerational justice.[51] Many recent examples demonstrate successful economic returns on investment from restoration, or else show great promise to do so.[52] Here we will cite only a few. Conservation International and numerous other conservation organizations are conducting research on ways to bundle benefits related to biodiversity conservation, restoration, and increased flows of ecosystem services, such as those related to carbon and water services[53] and agriculture.[54] Aronson *et al*.[17] offered descriptions of 19 additional RNC projects, some of which are described below (cf. Ref. 55 for four additional case studies from Latin America).

Overcoming the ideological divide

Bridging the divide between mainstream economists and ecologists becomes easier every time degraded natural ecosystems are restored and production systems are rehabilitated in RNC programs.[56,57] For example, New York City's decision to restore the Catskill–Delaware watersheds increased the supply of potable water and saved several billion dollars that would have ordinarily been spent on engineering solutions—thus encouraging new watershed protection programs for other U.S. cities.[58,59] The creation of more such long-term projects will be critical to demonstrate the worth of RNC programs to policy makers and others who are ignorant of, or reluctant to accept, the RNC vision. The initiation of such projects will require that the maintenance of biodiversity and economic development no longer be considered as opposing concepts or goals.[3,60,61]

It is going to require hard work in the fields of communication and education (especially in training of economists and ecologists) to achieve the needed integration between ecologists and economists.[62,63] One such interdisciplinary learning network is ASSET Research (http://www.assetresearch.org.za) in South Africa, which teaches graduate students from both the environmental sciences and economic disciplines to think in an integrative way. In seeking to achieve this, ASSET's flagship project is a meta-analysis of South Africa's restoration projects assessing eco-restoration's ecological, hydrological, and economic impacts.[64] Arguably the best way for both environmental scientists and economist to learn from each other and to co-develop new ideas is to work together on projects. Practical, real-world demonstration projects are ideal laboratories for developing and sharing ideas and information. It is in such a context of collaboration for shared goals that it will be possible to demonstrate the net-economic benefits of investing in natural capital through restoration, for example, and to help reduce the dearth in information flow between the scientific disciplines.

Various examples of such collaboration exist on both local and regional levels. For example, large-scale river and riparian vegetation restoration projects often encounter a range of social barriers and potential bridges, as well as biophysical problems that require solutions. In an on-going project aimed at restoring a large portion of the Sacramento River in north-central California, conflicts have arisen due to perceived negative impacts. Methods for resolving these conflicts are now themselves a major component of the research and management program.[65] Similarly, Pejchar *et al*.,[66] Schuyt

et al.,[67] and Craig and Vézely[68] all illustrate serious prospects for overcoming ideological divides through RNC projects.

Ecotourism also represents a promising avenue for holistic and sustainable economic development.

Overcoming the economic development divide

RNC offers new development perspectives to both economically rich and poor regions and countries, but for different reasons. Due to pressing socioeconomic needs in economically disadvantaged regions and nations, RNC has already taken the form of an alternative development strategy in some countries. That is, RNC directly and immediately benefits poor human communities while simultaneously investing in the environment. For example, the Working for Water program in South Africa restores both social and natural capital by hiring tens of thousands of unemployed people to clear invasive alien plants from infested watersheds, thus restoring indigenous biodiversity, replenishing arable land, and augmenting groundwater.[69] Related programs (Working for Wetlands and Working for Woodlands) focus on the restoration of South Africa's wetlands and woodlands. By restoring degraded landscapes, natural, financial, and social capitals are augmented simultaneously. Seeking to achieve a plethora and divergent objectives is not without its challenges, but Working for Water has repeatedly shown itself to be flexible and innovative in recognizing and resolving them, making the program a particularly valuable case study for large-scale RNC work in developing countries.

Also in South Africa, another promising RNC and regional land use management project recently began in the Drakensberg Mountains,[56] where the challenge is to reconcile the sometimes conflicting objectives of impoverished small-scale farmers, affluent commercial farmers, conservation groups, and large water users. The aim is to achieve this through identifying and developing markets for the delivery of ecosystem services related to water use, water quality, carbon sequestration, reduction of erosion and subsequent sedimentation, reversal of desertification, and promotion of biodiversity conservation. Many RNC initiatives are emerging from economically poor countries, sometimes linked to traditional ecological knowledge among indigenous peoples, which often favors the maintenance of biodiversity.[70] RNC should not be seen as a solution that the economically rich countries can impose on their poorer counterparts, but rather as a convergence that helps overcome the deep social, economic, political, and cultural divides characterizing our world today. The bridge across this divide must be built from both sides.

In economically advantaged countries, most RNC projects are likely to be capital-intensive rather than labor-intensive and are relatively expensive compared to those in poor countries. Nonetheless, RNC generally proves to be much cheaper than substituting human-made capital, as exemplified by the Catskill and Drakensberg watershed projects cited above.

Unfortunately, such initiatives are still too uncommon, and overconsumption continues to deplete natural capital[21,71] in both advantaged and disadvantaged regions. Meanwhile, middle-income nations (exemplified by the so-called BRICS-countries, which are Brazil, Russia, India, China, and South Africa) are demanding more and more consumer goods, thereby putting new pressures on our dwindling global natural capital base. RNC thinking, by linking economic and ecological realities, will make environmentally sustainable economic and social planning more easily negotiable and acceptable. Disparities between economically rich and poor nations could then be surmounted, at least partially, through joint investments in conservation, sustainable development, and RNC that will benefit all. The advent of markets for ecosystem services offers splendid opportunities for such joint activities.[72,73] Such markets are in their infancy and are as open to abuse as any others, but they have the novel virtue of ensuring that the value of ecosystem services are properly taken into account by economists (see Fig. 1).

Overcoming the information divide

As we have seen, the current global failure to bridge the information divide has several causes, including deliberate information blockage by certain interest groups, and the ideological divide we have addressed above. However, in open societies, the key factor in bridging this divide will be a greatly improved media and communications strategy from environmental researchers and activists.

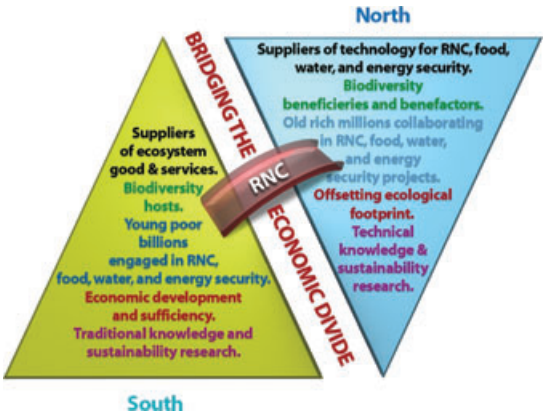

Figure 1. RNC: Crossing the economic development divide. (In color in *Annals* online.)

In general, the problem does not lie in failure to generate information, such as that contained in the Millennium Ecosystem Assessment[2] and the TEEB reports,[3] or to "make it available." But "making information available" is not the same thing as communicating it. Rather, resolving the problem requires the changing of mindsets through more integrated communication of ecological economics. Such a major paradigm shift will require leadership at all levels. It will also require financial mechanisms, both dissuasive and incentive in nature.

Hard work (especially in the training of economists and ecologists) will be needed to achieve the improved information flow needed to integrate these ecological indicators into economic thinking. And conservationists and environmental activists need to communicate their experience in terms relevant to mainstream public opinion. The RNC approach has inherent advantages in education and media terms because it comes with a holistic communications strategy "built-in," as it were. This is because it rationally links environmental and economic benefits at every stage of a project and does not rely on solely ethical or emotional appeals. Each RNC project establishes a series of communication channels to the community in which it takes place, and can provide lessons for similar communities across the world. We suggest that the information divide illustrated in Figure 2 can be bridged by introducing an RNC approach to socio-economic development.

In bridging the information divide, the following points also need to be taken into consideration:

(1) Communication in and of itself does not necessarily induce to behavioral change, especially when the requirement is to give up something that is valued. The case of the dangers of tobacco smoking, for example, shows that a communications strategy needs to be complemented by a social marketing strategy and positive and negative incentives.[74]
(2) Effective interventions require at the outset social assessment of the needs and values of stakeholders, and the capacity of their institutions. This enables realistic mainstreaming strategies to be formulated.[75]
(3) Getting scientific knowledge incorporated into policy requires that the research is socially engaged (user-inspired, user-friendly, and user-useful). Many communications failures are caused by researchers operating in isolation from their communities, and assuming policy uptake will simply "happen" through the (incredibly ineffective) trickle-down mode.[62,76]
(4) Researchers and policy makers (including politicians) usually have different worldviews (mental models), timelines, and priorities. These need to be understood by both groups to improve communication between them.[77]

Through the dissemination of RNC projects we envisage a mutually sustaining process of change through improved flows of information—changes in mindset will produce changes in the rules of our economic system; and changes in our economic system, generating positive results, will result in further changes of mindset. This process will also require fundamental changes in our educational systems, from kindergartens to graduate schools. At present, a growing number of children make no connection between milk and cows, or between wood products and forests. We need to reverse this alienation through pedagogy in which the linkages between our environment, our economy, and our cultures are highlighted at every level.

There must also be a major shift in the approach of the media, which tends to promote unfettered consumption through its advertising, and its political, business, and lifestyle coverage. "Environmental" stories are certainly carried in ever-increasing quantities, which is a positive development. But they

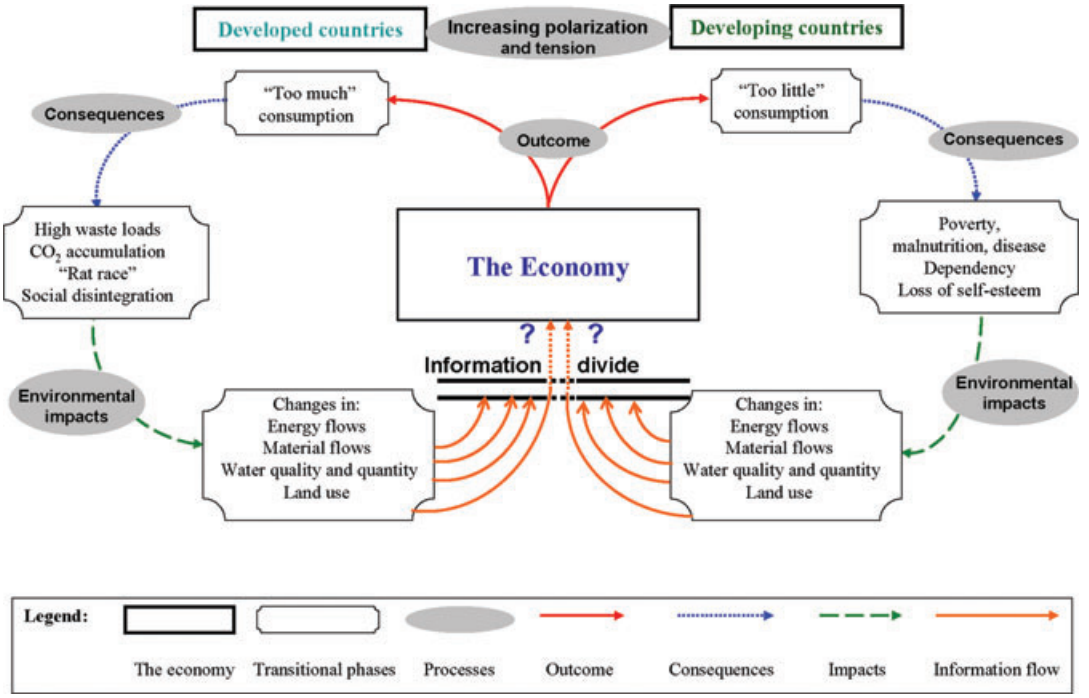

Figure 2. Overcoming the information divide. Simplified state and transition model of the global, consumption-based economy with indications of its various outcomes and environmental impacts in developed and developing countries (modified from Ref. 51). Overexploitation (often begun under colonial periods), combined with inequity and inequitable distribution of economic goods and services, compounds the problem of underconsumption in developing countries. RNC could play a vital role in overcoming the information divide portrayed in the middle of the figure and thus lead to modifications in the unrelenting (and unsustainable) search for perpetual economic growth. (In color in *Annals* online.)

tend to be ghettoized either as "feelgood" entertainment or as sensational disaster stories, ignoring the context of the larger global narrative in which they occur. As the high media profiles of the Catskill and Working for Water projects have demonstrated, RNC projects have sufficient human drama to generate a plethora of news stories and features which assist the public in understanding the connections between investing in natural capital, ecosystem health, and economic well-being.

Conclusion

Over the past two decades we have, for the first time ever, crossed an important threshold whereby we consume more ecosystem services than are being produced.[1] This is clearly unsustainable. While it is essential to reduce global consumption and also work toward the stabilization of population growth, these options are not attainable in the near future. There is clearly neither sufficient political will nor the social capital to embark on large-scale projects that will address these issues adequately at this stage. We have illustrated that an RNC strategy has the potential to change this situation through its bridge-building capacity across ideological, economic, and information divides. This concept can play a key role in achieving popular consensus on how to tackle important environmental and societal problems simultaneously. In so doing, the economy can be developed in ways that were previously thought impossible. "What gives me hope is that I know social systems are just as non-linear as the many biological systems I've been studying," says ecologist Paul Ehrlich. "Just as there are thresholds in ecosystems, there are thresholds in human behavior, times when cultural evolution moves unexpectedly rapidly. . . . When the time is ripe, society can be transformed virtually overnight—and that could occur in our treatment of the environment in general and natural

capital in particular. Our challenge now is to find ways to ripen the time" (quoted in Ref. 59, p. 233).

Such a paradigm shift will require imaginative and courageous leadership at all levels, along with incentive and dissuasive financial mechanisms.[78] We are not suggesting that any of this will be easy to achieve. But if such efforts are successful, self-perpetuating changes in mindset can take place that open up the road to a sustainable and equitable future, in our relationships with each other, and with the planet on which—and through which—we live.

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Conflicts of interest

The authors declare no conflicts of interest.

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