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Managing the sustainable development of small island states

Introduction

Garrett Hardin, in his seminal examination of the un-sustainability of openly-accessible natural resources in the face of population growth, noted that the dilemma of market failure could not be resolved by technical means. Since Hardin's analysis in the 1960s, global annual population growth rates have declined to below 1 per cent in industrialised countries and in Eastern Europe to just above replacement level. The role of population growth as the principal factor in denying future generations the benefits of current levels of natural resources is diminishing. But, in small and island states, the tragedy of the commons¹ is exacerbated by their inherent economic and environmental vulnerability. A loss in the value of environmental quality can quickly have a negative effect on economic development, quality of life and social welfare of local communities.

Opportunities for solutions to Hardin's dilemma can be sought in improved governance. However the application of managerial theory to environmental governance is in its infancy. Much effort has been given to the identification of outputs and outcomes (such as through the development of performance indicators, the monitoring of climate change and the development of specific economic and regulatory instruments); but less attention has been given to the institutional framework for management, the public-private interface, the study of management behaviour and the economics of production functions in the delivery of environmental goods and services.

This chapter explores what action is being taken in small states and islands to improve the management of the Commons in the pursuit of sustainable development. Using fresh data, indices and information this chapter reviews the linkage between economic and social development and environmental governance. It emphasises the importance of establishing evidence-based guidelines for efficient investment for securing social well-being in SIDS and other small states. It is the small states, especially SIDS, that have most to lose if their environmental quality should decline in their quest to overcome their economic vulnerability. This chapter identifies areas for further study.

Economic resilience

Briguglio et al. (1995) have shown that capacity for economic resilience varies for differing levels of economic vulnerability. From available data, it is evident that many SIDS and other small states have built levels of economic resilience in the face of high economic vulnerability (the 'self-made' states).

The 'self-made' states² have levels of economic resilience as high as that achieved by other developed countries with lower economic vulnerability (the 'best-case' states). Singapore has been shown to have both high economic vulnerability and high economic resilience and it has been argued by Briguglio et al. (2006), that, in these economic terms, it is a model case, although its marginal capacity for resilience is low by comparison with countries with lower economic vulnerability.

From a perspective of economic policy for SIDS, we may ask what options are available to those SIDS with high inherent economic vulnerability and low nurtured economic resilience (Briguglio's 'worst-case' states) to increase their economic resilience and to cross the threshold into 'self-made' status? The rationale of the Briguglio index implies that the road to success is by improvement in the component elements in the index itself, such as nurturing greater macro-economic stability, market efficiency, good governance and social development.

So from a sustainability perspective, and in line with the Mauritius Strategy (UN, 2005), we should also ask what is the environmental price of achieving such transition and what can be done to mitigate this price whilst sustaining economic growth. SIDS are also vulnerable to environmental shocks, from their inherent exposure to extreme weather conditions, natural disasters and from the increasing risks of exogenous factors promoting climate change (UNEP, 2007 pp. 333–336, IPCC (2007) AR4). However, their capacity for adaptation is more constrained than that of larger, less isolated and fragmented countries, due to lack of specialisation in technical skills, and elevated population density and growth rates that put environmental pressure on limited coastal areas with their fragile ecologies. In many islands these combined pressures have induced substantial migration, as in the Pacific islands of Tonga, Tuvalu, Kiribati and Fiji and produce major adverse affects on basic infrastructure, industrial facilities, services and housing.

Roberts (2006) argues that sustainable use of natural resources in SIDS requires appropriate information which in many places is fragmentary and insufficient for strategic decision-making. Further, he has noted that the use of MDGs may adversely bias investment as they omit reference to key aspects of natural resources and environmental vulnerability especially in SIDS. This information is vitally relevant to island states whose development is closely linked to the quality and sustainability of natural capital such as coastal and marine resources, biodiversity, land resources and the effective management of the risks of natural disasters. Moreover, it was argued that, for each small island state, the development stage that it has reached affects the pressures on its natural capital, and its priorities for building resilience.

Roberts (2006) further argued that the capacity to overcome adverse economic and environmental pressures needs to be built across a range of elements of governance, including environmental systems, environmental stress, human vulnerability, social and institutional capacity and global stewardship. Technical fixes in specific areas such as energy production, waste management and marine conservation are not enough. Only by a long-term and multi-sector process can SIDS expect to achieve sustainable development, to provide nurtured resilience against inherent and acquired vulnerability from exogenous and endogenous sources. This does not imply that central planning holds the key to solving

Hardin's dilemma. The forms of governance may be varied but it is the evolution of a wider range and a sharper focus that is likely to be critical. At the core of the issue is clarifying the concepts of development, well-being and the nature of progress.

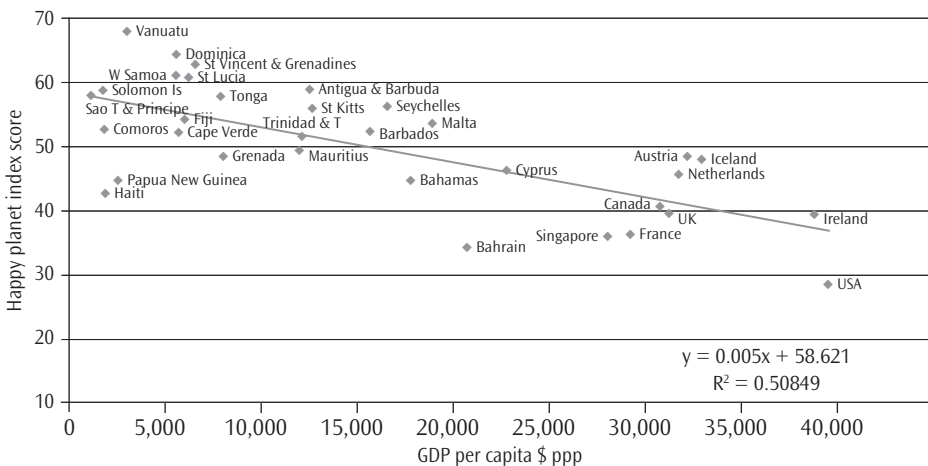
Examples of resilience building have been categorised against classes of factors associated with vulnerability, including isolation, small resources base, risk of climate change and sea level rise, land degradation, water, pressure from visitors and tourists, security and health risks, and restricted mobility (see Roberts, 2006).

Well-being and development

Marks et al. (2006) have used the Happy Planet Index (HPI), which is based on the ratio of social well-being over ecological impact³, to show that many SIDS seem more efficient at deriving social well-being from the use of environmental resources, than more developed, richer and larger countries. Indeed there emerges from the New Economic Foundation (NEF) data a negative correlation between HPI and Gross Domestic Product (GDP) per capita (see Figure 22.1).

It can be seen that SIDS in various regions, such as Vanuatu (in the Pacific), St. Lucia (in the Caribbean), Sao Tome and Principe (in the Atlantic) and the Seychelles (in the Indian Ocean) – which together contribute less than 2 per cent of the projected population growth in SIDS – appear more efficient at deriving social well-being from the use of their natural resources, given the level of their GDP per capita, than other island states such as Bahrain and Singapore, together with larger developed countries such as USA and France. Singapore has a heavy per capita ecological footprint and its population is expected to rise by over 600,000 by 2015, the fourth highest growth in population in all SIDS, after Haiti, the Dominican Republic and Papua New Guinea⁴.

Figure 22.1. GDP per capita and Happy Planet Index – SIDS and other countries



Sources: UNDP (2006) and Marks, N. et al. (2006)

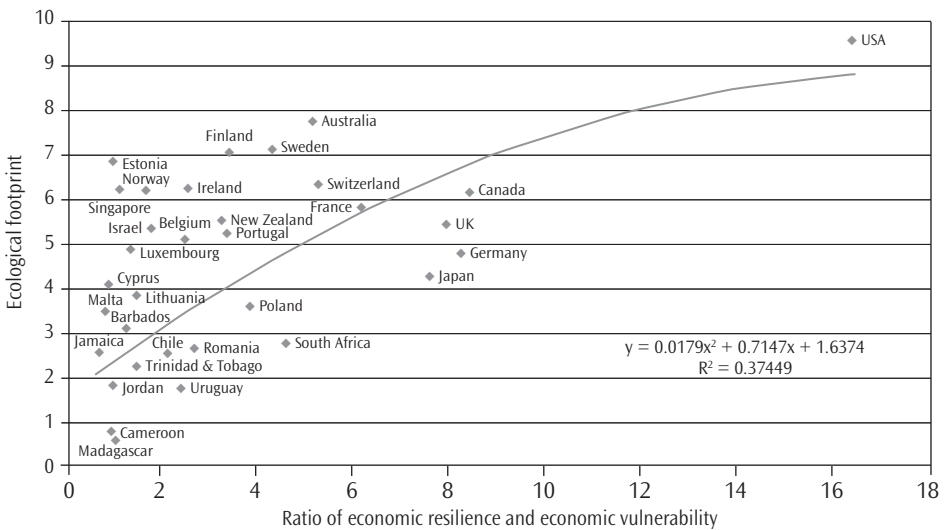
This analysis raises important questions for defining progress. For example, is the Singapore development model to be followed? We may also ask what can countries like Singapore do to reduce the impact its economic development is having on its environmental sustainability? Briguglio et al. (2006) have shown that the economic resilience of countries is strongly and positively associated with GDP per capita. But is the economic development and the nurtured economic resilience they have achieved worth the adverse impact on their natural environment? Sustainable development requires that economic resilience building must also incorporate responses to the risks of environmental damage from the externalities of economic and social development.

Assessing the environmental price of economic resilience

Using the HPI disaggregated data combined with Briguglio et al. (2006) data, it is evident that overcoming economic vulnerability with nurtured economic resilience can carry a heavy price (see Figure 22.2). Some economically 'self-made' SIDS, such as Singapore, Cyprus and Malta have an ecological footprint as heavy as that of Japan, Germany, Canada and France, though below the levels of USA, Australia and Sweden. Other self-made SIDS such as Barbados, Trinidad and Tobago, and Mauritius, carry a rather lower ecological footprint.

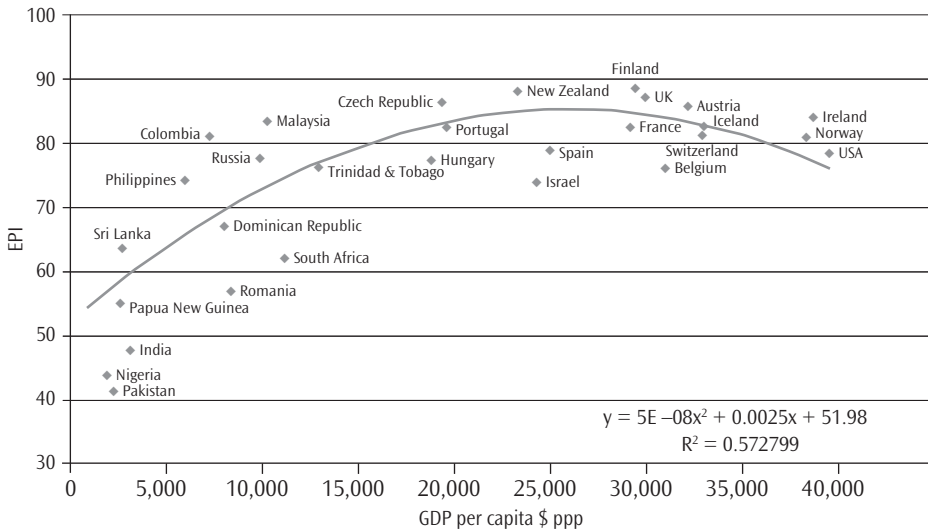
The Yale Environmental Performance Index⁵ is one tool being developed for assessing progress made by countries in meeting a range of environmental governance targets (Esty et al., 2006). Using data from a 2006 pilot study, it appears that EPI increases with GDP per capita

Figure 22.2. Ratio of economic resilience to economic vulnerability and ecological footprint



Sources: data from Briguglio et al. 2006 and Marks, N. et al. (2006)

Figure 22.3. GDP per capita and environmental performance index



Sources: data from UNDP (2006) and Esty, D.C. et al. (2008)

to a point, but then, with each increase of GDP per capita, the score on the HPI declines (see Figure 22.3). This suggests that there may be an environmental cost at higher levels of economic development⁶. The interpretation of these data should, however, take into account a number of factors, such as the absence of many small and island states from the study; the use of performance targets separately assigned to each country; and the limitations inherent in cross-sectional analysis rather than longitudinal analysis of data for each country.

The challenge of de-linking growth and environmental degradation has been documented through broad theoretical analysis of the potential for establishing a Kuznetz curve of declining environmental degradation with increasing GDP per capita after a certain point of growth (Steer et al., 1992) and more recently with detailed inter-country, secular comparisons focusing on pollution outcomes (Dasgupta, P.S. et al., 1999).

Costs of environmental protection

Countries with high economic resilience tend to have higher income per capita and an economic structure that emphasises industrial production and service industries, with high use of energy. In such countries we can expect the marginal utility of income to be falling and the marginal disutility of pollution to be rising as people with higher incomes increasingly seek environmental quality in their lives. At the same time, the marginal costs of abatement are likely also to be rising. In SIDS and other small states, their size determines that the costs of abatement are spread over a small volume of production and the benefits enjoyed by a small population, severely limit the cost-effectiveness of abatement. It should also be recognised that in SIDS and other small states, technical, and institutional capacity for developing effective abatement is low, and environmental NGOs are few and weak. Furthermore, local commercial and political pressures to maximise short-term gains tend

to ensure a high discount rate for securing long-term benefits for environmental protection for future generations (Dasgupta et al., 1999).

Juxtaposing costs against benefits

Many small and island states are low income countries with large sections of the population at a modest level of human development. Such social groups may have a low aversion to pollution and comparatively low levels of education and exposure to information and media pressure for protecting environmental quality. However, investment in tourist services in SIDS produces a sharper focus on the environmental and commercial costs of pollution which can act as a countervailing pressure for regulation and voluntary controls and standards, in contrast to the demands and priorities of the local resident population. The costs of environmental protection of the tourist industry in SIDS are increasingly being assessed by international operators against the benefits relating to quality of life and long-run economic development, especially in those remote SIDS where the transport costs encourage high-priced tourism. SIDS are also developing regional capacities for providing environmental protection as part of their sustainable development strategies, through which the fixed costs of R & D and abatement technology and their benefits can be spread over a larger market.

The misery of overpopulation

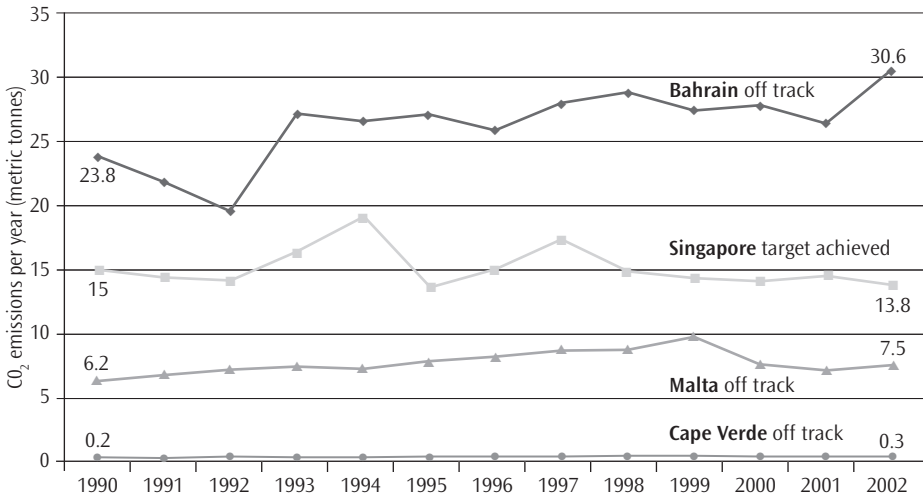
Analysing the impact of development in terms of the ecological footprint per capita conceals the core of Hardin's dilemma in the *Tragedy of the Commons*, namely the 'misery of overpopulation'. In the 1960s, like Meade⁷, Hardin was justifiably concerned at the alarming prospects of a global population explosion. Population growth has markedly slackened since then⁸ and in SIDS over 80 per cent of the projected increase in population of 7.9 million from 2003–2015 is concentrated in just seven of the 46 states for which UN population data are available⁹. The demographic issue is also shifting in just one generation from over-fertility to longevity. This demographic transition is accompanied by a re-examination of the economic production function, in which security, quality of life, positive health, disease free longevity, life satisfaction and the use and non-use values of the natural environment are counterpoised in the social scales against forever increasing the volume of income from production of goods and services¹⁰.

Loss of natural resources

The loss of environmental quality in small and island states is being monitored internationally but the results are ambiguous. Take for example the UN target to improve air quality. The UN reported data from 1990 to 2002 for four of the AIMS region SIDS, Bahrain, Singapore, Malta and Cape Verde, with the implied assessment of progress with meeting the UN MDG target (Figure 22.4).

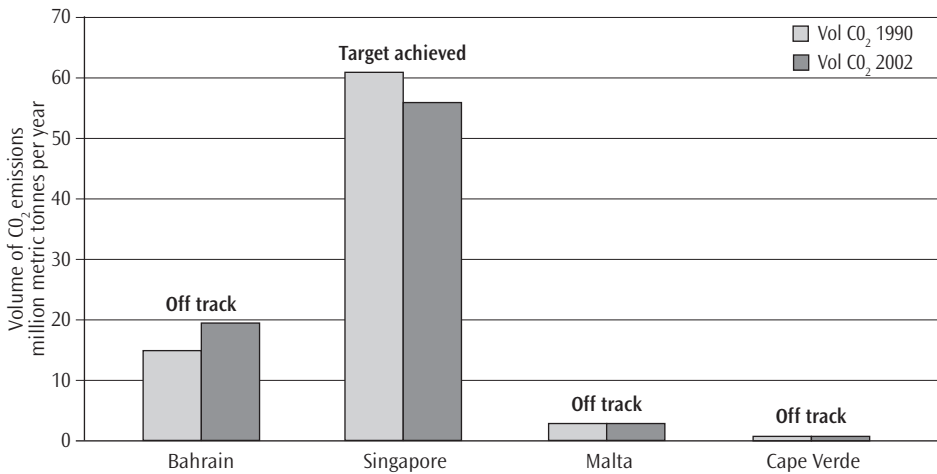
Three of the countries may be judged off-track, as their 2002 levels of CO₂ emissions per capita are higher than the 1990 baseline. But, if we take total emissions per country per year, (which is not an indicator in the MDG system), then the picture changes (Figure 22.5).

Figure 22.4. Progress with MDGs in AIMS region; selected country's CO₂ emissions per head per year: Goal 7 target 9 indicator 28



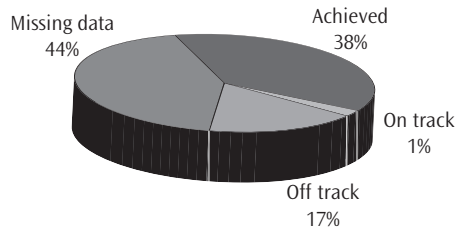
Source: UN Statistics Division 2006

Figure 22.5. Progress with MDGs in selected AIMS countries; total volume of CO₂ emissions 1990 and 2002



Source: UN Statistics Division 2006

Figure 22.6. AIMS Country's 1990–2004 progress with environmental MDG 7



Source: UN Statistics Division 2006

Despite the downward trend, it can be seen that Singapore's levels of CO₂ emissions are nearly three times greater than those of Bahrain and totally overshadow the modest levels recorded for Malta and Cape Verde.

Whilst use of the UN MDG data sets can be illuminating, they are beset with issues of interpretation and relevance for planning. One other major problem for the assessment of progress is missing data. It is evident that taking the MDGs as a whole there are major gaps in the evidence available for judging progress with environmental governance. Missing data have been identified in 29 per cent of MDG indicators for small states¹¹ in up to 74 per cent of indicators examined by UNEP¹² and in 48 per cent of indicators examined in a study on the AIMS region for the IOC in 2007¹³.

Environmental governance practice in SIDS

Action being taken in SIDS to address the issues of environmental governance and management of the commons is diverse and encouraging. Tables 22.1 and 22.2 present summaries identifying examples of critical activities being undertaken in the SIDS AIMS region for better environmental governance to promote greater environmental resilience and economic and social development. The information is derived from country strategic documents and international aid programmes. The activities are classified both in terms of the dimensions of environmental governance adopted by the Yale study on environmental resilience and by the principal aspects of vulnerability affecting SIDS, identified by Roberts (2006). The range and focus of activities offers hope for a better management of the commons. But the information available has substantial gaps especially in providing a firm basis of evidence for assessment of the investment required for scaling up the endeavours for the benefit of all SIDS in the light of results achieved.

Table 22.1. Examples of environmental performance

Dimensions of environmental performance				
Environmental systems	Environmental stress	Human vulnerability	Social and institutional capacity	Global stewardship
<p>Sensitive ecosystems: Bahrain: coastal and marine development (IOC, 2004: 113–116).</p>	<p>Soil degradation: Cape Verde: Natural resource management to combat desertification and promote new livelihoods (UNDP, 2005: 42).</p>	<p>Health: Comoros: Public health programmes to reduce the impact of infectious disease epidemics including malaria and water-borne diseases with projects to improve water collection, treatment and distribution systems (Union of the Comoros, 2005).</p>	<p>Environmental governance: Bahrain: Nationally led environmental strategy, with 9 sectoral working groups (MDGR, 2003).</p>	<p>Greenhouse gases: Mauritius: Removal of barriers to energy efficiency (UNDP, 2005: 84–85).</p>
<p>Biodiversity: Cape Verde: Fruit bat conservation Water: Cape Verde: Agricultural irrigation to implement projects to increase irrigated land areas by at least 40% (FAO, 2005).</p>	<p>Waste management: Comoros: Programme to improve the quality of life and hygiene in urban areas (covering pollution, household refuse, insalubrity and neighbourhood disputes systems (Union of the Comoros, 2005).</p>	<p>Health and economic security: Guinea Bissau: Mine clearance in Quinta Nanque forest (UNDP, 2005: 68–69)</p>	<p>Environmental governance: Cape Verde: Integration of environmental policy with PRSP 2002 (Cape Verde, 2004), and within Medium Term Sectoral Expenditure Framework, including education, water, soil and biodiversity.</p>	<p>Environmental impacts of trade: Singapore: Fisheries management to control poaching and sustain endangered species and stock depletion of yellow fin and bigeye tuna, sea cucumber, turtle, shark, lobster.</p>

Environmental systems	Environmental stress	Human vulnerability	Social and institutional capacity	Global stewardship
Biodiversity: Comoros: Marine biodiversity management for poverty relief in 10 village communities (UNDP, 2005: 48–49).	Pollution, soil degradation: Cyprus: Protection of the atmosphere, combating deforestation, desertification (UN, 2002).	Natural disasters: Maldives: Adaptation to the impact of the 2004/5 Tsunami (UNEP, 2005).	Environmental governance: Cyprus: Promotion of agro and eco-tourism projects (UNDP, 2005).	Environmental impacts of trade: South West Indian Ocean: Fisheries management in Indian Ocean countries, with tuna tagging and marine area monitoring system (IOC EDF projects see www.coi-ioc.org)
Water: Guinea Bissau: 145 boreholes and water pumping system.	Waste: Malta: Priority areas for action include waste management to meet EU waste related objectives and targets.	Health: Sao Tome & Principe: Anti-malaria programme, HIV/AIDS programme (IDA et al, 2005). ¹⁷	Environmental governance: Malta: Policy development through a Sustainable Development Authority, Parliamentary mechanisms, environmental court, and NSDS (Malta, NCS, 2006; Aquilina, 2004).	Greenhouse gases: Sao Tome & Principe: National communication to the UNFCCC, GHG inventory and risk assessment (UNDP, 96–97).
Biodiversity: Maldives: Atoll ecosystem conservation project at Baa Atoll (UNDP, 186–187). With protected areas, and alternative livelihoods.	Water and waste management services: Sao Tome & Principe: Programmes to improve water supply and sanitation and proper disposal of solid waste (IDA et al., 2005).	Health: Mauritius: Eradication of malaria (Roberts, 2004).	Environmental governance: Mauritius: Building up sustainable land management capacity (UNDP, 2005 p. 84).	Greenhouse gases: Guinea Bissau: Reduction of ozone depleting substances and GHGs; retrofitting refrigerators; recycling old machines; and training of technicians (UNDP, 2005, 68–69).

Environmental systems	Environmental stress	Human vulnerability	Social and institutional capacity	Global stewardship
<p>Water, air, biodiversity and sensitive ecosystems: Malta: priority areas for action include: air quality, nature and biodiversity, groundwater, seawater, land use (Malta NCSD, 2006).</p>	<p>Waste management: Singapore: reducing, reusing and recycling waste.</p>	<p>Health: Cyprus: Co-operation between Greek and Turkish Cypriot chambers of engineers; programme on improving milk quality, with Madison Dairy Advisory Group; island-wide eradication of brucellosis (UNDP, 2005: 228–229).</p>	<p>Eco-efficiency: Seychelles: Renewable energy for remote islands.</p>	<p>International collaboration: Montreal Protocol: Maldives: Awareness and incentive programme in refrigeration management plan (UNDP, 2005).</p>
<p>Water: Mauritius: Expanding water supply system: only 57% of population have a 24 hour service and water stress conditions apply (IOC, 2004: 52).</p>		<p>Safe drinking water: Guinea Bissau: new hydraulic water pumping systems at village level; 145 boreholes; improving health and liberating time for alternative employment. www.gw.undp.org/environment</p>	<p>Eco-efficiency: Mauritius: Sugar bio-energy technology, using sugar cane (bagasse and ethanolproducts) as substitutes for oil-based energy production and transport fuel www.un.intnet.mu/undp/html/Mauritius/energy_env.htm.</p>	<p>International co-operation on Green House Gases: Refrigeration: Bahrain: Programme for replacement and retrofitting of equipment and units, testing, trials and training (UNDP, 2005: 122–123).</p>
<p>Biodiversity and sensitive ecosystems: Sao Tome & Principe: Obo nature reserve project, to combat deforestation, to protect endangered species and promote livelihoods (UNDP, 2005: 96–97).</p>	<p>Cultivation and water systems: Seychelles: Programme to extend agricultural areas and equip them with roads and water systems (Seychelles Ministry of Agriculture and Marine Resources, 2006).</p>	<p>Marine biodiversity project Moheli: Comoros: saving the endangered ‘sea-cow’ dugong; community based approach to marine resources management and eco-tourism. www.km.undp.org/biodiversite</p>		

Table 22.2. Some examples of interventions in AIMS to overcome environmental vulnerabilities

Factors associated with environmental vulnerability	Interventions undertaken in AIMS countries
Climate change and sea level rise	<p>Sao Tome & Principe: National communication to the UNFCC, GHG inventory and risk assessment (UNDP, 2005: 96–97).</p> <p>Guinea Bissau: Reduction of ozone-depleting substances and GHGs; retrofitting refrigerators and recycling old machines with training of technicians (UNDP, 2005: 68–69).</p> <p>Maldives: Awareness and incentive programme in refrigeration management plan (UNDP, 2005).</p> <p>Bahrain: Programme for replacement and retrofitting of equipment and units, testing, trials and training (UNDP, 2005:122–123).</p>
Coastal and marine	<p>Bahrain: coastal and marine development (IOC, 2004: 113–116).</p> <p>Comoros: Marine biodiversity management for poverty relief in 10 village communities (UNDP, 2005: 48–49).</p> <p>Singapore: Fisheries management to control poaching and sustain endangered species and stock depletion of yellow fin and bigeye tuna, sea cucumber, turtle, shark, lobster (Republic of the Seychelles, 2004).</p> <p>South West Indian Ocean (including Seychelles, Mauritius, Comoros, La Réunion): Fisheries management in Indian ocean countries, with tuna tagging and marine area monitoring system (IOC, EDF projects, see www.coi-ioc.org).</p>
Desertification	<p>Cape Verde: Natural resource management to combat desertification and promote new livelihoods (UNDP, 2005: 42).</p>
Destruction of coral reefs	<p>Seychelles working with the International Coral Reef Initiative, http://www.coralreef.gov/international/mainb.html</p>
Land degradation	<p>Cape Verde: Agricultural irrigation to implement projects to increase irrigated land areas by at least 40% (FAO, 2005).</p> <p>Maldives: Atoll ecosystem conservation project at Baa Atoll (UNDP, 2005: 186–187). With protected areas, and alternative livelihoods.</p> <p>Sao Tome & Principe: Obo nature reserve project, to combat deforestation, to protect endangered species and promote livelihoods (UNDP, 2005: 96–97).</p>
Loss of biodiversity	<p>Cape Verde: Fruit bat conservation</p> <p>Malta: priority areas for action include: air quality, nature and biodiversity, groundwater, seawater, land use (Malta NCS, 2006).</p>
Natural disasters	<p>Maldives: Adaptation to the impact of the 2004/5 Tsunami (UNEP, 2005).</p>

	Mauritius: Early warning systems against cyclones in the Western Indian Ocean (Roberts, 2004).
Pollution	Cyprus: Protection of the atmosphere, combating deforestation, desertification (UN, 2002).
Pressure from visitors and tourists	Cyprus: Promotion of agro and eco-tourism projects (UNDP, 2005).
Security and health risks	Comoros: Public health programmes to reduce impact of infectious disease epidemics including malaria and water-borne diseases with projects to improve water collection, treatment and distribution systems (Union of the Comoros, 2005). Guinea Bissau: Mine clearance in Quinta Nanque forest (UNDP, 2005: 68–69). Sao Tome & Principe anti-malaria programme, HIV/AIDS programme. Mauritius: Eradication of malaria (Roberts, 2004).
Waste management	Comoros: Programme to improve the quality of life and hygiene in urban areas (covering pollution, household refuse and neighbourhood disputes (Union of Comoros, 2005). Malta: priority areas for action include waste management to meet EU waste-related objectives and targets. Sao Tome & Principe Programmes to improve water supply and sanitation and proper disposal of solid waste (IDA et al., 2005). Singapore: reducing, reusing and recycling waste (Case Study 1, see Annex 1).
Water stress	Guinea Bissau: 145 boreholes and water pumping system. Mauritius: Expanding water supply system: only 57% of population have a 24-hour service and water stress conditions apply (IOC, 2004: 52). Seychelles: Programme to extend agricultural areas and equip them with roads and water systems (Seychelles Ministry of Agriculture and Marine Resources, 2006). Cape Verde: Integration of environmental policy with PRSP 2002 (Cape Verde, 2004) and within Medium Term Sectoral Expenditure Framework, including education, water, soil and biodiversity.
Weak energy use and supply management	Seychelles: Renewable energy for remote islands. Mauritius: Sugar bio-energy technology, using sugar cane (bagasse and ethanol products) as substitutes for oil-based energy production and transport fuel (www.un.intnet.mu/undp/html/mauritius/energy_env.htm) Mauritius: Removal of barriers to energy efficiency (UNDP, 2005: 84–85).
Lack of environmental governance systems	Malta: Policy development through a Sustainable Development Authority, Parliamentary mechanisms, environmental court, and NSDS. (Malta NCSD, 2006; Aquilina, 2004) Mauritius: Building up sustainable land management capacity (UNDP, 2005).

Conclusion

SIDS suffer from inherent economic and environmental vulnerability as well as from acquired environmental vulnerability associated with the externalities of economic and social development from endogenous and exogenous sources. Those SIDS at an early stage of economic development enjoy higher benefits of social well-being and impose on their natural resources a lower ecological footprint than many more developed SIDS and larger continental states. The misery of population growth is diminishing since Hardin's exploration of the tragedy of the commons and it is concentrated in a minority of states, thus reducing the overall increased pressure on natural resources in SIDS.

Whilst the evidence base for cost-effective intervention is thin, many SIDS that are increasingly dependent on their growing tourist trade are seeking to implement long-term, integrated economic and environmental sustainability programmes, nurture their natural resources and curb the adverse impact of economic development through a variety of technical and behavioural measures. Declining population growth and improved environmental governance may yet provide the fix to Hardin's dilemma as perceived a generation ago. Institutional development for better management of the commons has to be the subject of critical review to provide an effective balance between international, regional and national governance taking into account the specificities of small states and islands. Models from developed countries are not likely to be the best fit (Chang, 2006).

The progress of small and island states will also depend on their influence on international accords to reduce the adverse global environmental impact of population growth and the degradation of natural resources in other larger states, especially those contributing most to climate change and sea level rise, two key risk factors to the economic and environmental resilience for SIDS.

A critical element in tackling Hardin's dilemma is the establishment of an evidence base on the best practices for SIDS in achieving these objectives. Greater south-south co-operation in information exchange between SIDS is also desirable for better governance and more cost-effective technical and behavioural adaptation.

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Notes

- 1 See Glossary.
- 2 The 'self-made' states have high vulnerability and high resilience.
- 3 The elements in the Happy Planet Index (HPI) by country are: (mean life satisfaction score x expectation of life)/ecological footprint. The function is thus per capita lifetime well-being per unit use of natural resources. Progress is achieved by enhancing the value of this function. The ecological footprint is a measure of the per capita use of natural resources; it is a measure of how much land is required to sustain a given population at its present levels of consumption, technical development and resource use efficiency. It derives from a concept developed by William Reese and Mathis Wackernagel at the University of British Columbia. The principal elements are land use to grow food, trees and bio-fuels, areas for ocean fishing and land required to support plant life needed to cope with waste such as carbon emissions from fossil fuels, see www.ecologicalfootprint.org and www.redefiningprogress.org
- 4 UNICEF database 2007.
- 5 The Index embraces 16 indicators for 133 countries. They are outcome or environmental state indicators, covering environmental health, air quality, water resources, biodiversity, productive natural resources and sustainable energy. They are grouped into two broad objectives of overall performance: environmental health and ecosystem vitality. The index includes measurable outcomes linked to policy targets but does not include institutional forms, legislative provision, treaty commitments, enforcement facilities or management arrangements.
- 6 The factors included in the measurement of GDP infer zero rating of all those natural resources and environmental services which do not appear as priced products or services exchanged in the economy.

- 7 See Meade, J.E. (1961) 'Mauritius – A case study in Malthusian economics', *Economic Journal* Vol. b71 (September) 521–34.
- 8 UN statistics show that the global annual population growth rates have declined from 2.7 per cent in 1970–1990 to 2.2 per cent in 1990–2003; in the industrial countries, the decline across these two periods has been from 1.1 per cent–0.9 per cent and in the CEE/CIS countries the decline has been from 2.0 per cent–0.2 per cent. In the LDC countries the decline has been from 4.9 per cent–4.4 per cent. See UNICEF (2006).
- 9 UNICEF (2006).
- 10 See Schumaker, E.F. (1973) *Small is beautiful, economics as if people mattered*, New York: Harper. Also see www.smallisbeautiful.org
- 11 Downes A.S. (2005) Progress towards achieving the Millennium Development Goals in the Small States of the Commonwealth, in: Coomaraswamy I. et al. (2005) *Small States economic review and basic statistics*, pp. 27–39. Commonwealth Secretariat, ISBN 10: 0-85092-831-1.
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- 13 Roberts, J.L. (2010). 'MDGs and SIDS: Issues of Performance and Use'; Chapter 13, in Roberts J.L. and Vigilance (Eds) *Tools for mainstreaming Sustainable Strategies in Small States*, (forthcoming) Commonwealth Secretariat.