系所組別： 資源工程學系丙組

考試科目： 資源管理問題解析 考試日期：0307，節次：2

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以下四題（每題占 25 分）請詳讀題目後，說明(1)該題目之主要重點（占 15 分）及(2)該題目之資源管理意涵（占 10 分）。（資料來源：Tom Tietenberg and Lynne Lewis (2009), Environmental & Natural Resource Economics, 8th Edition, Pearson International Edition）

一、

Can the demand for a public good such as biological diversity be observed in practice? Would the market respond to that demand? Apparently so, according to the existence of an organization called The Nature Conservancy.

The Nature Conservancy was born of an older organization called the Ecologist Union on September 11, 1950, for the purpose of establishing natural area reserves to aid in the preservation of areas, objects, and fauna and flora that have scientific, educational, or aesthetic significance. This organization purchases, or accepts as donations, land that has some unique ecological or aesthetic significance, to keep it from being used for other purposes. In so doing they preserve many species by preserving the habitat.

From humble beginnings, The Nature Conservancy has, as of 2006, been responsible for the preservation of 117 million acres of forests, marshes, prairies, mounds, and islands around the world. Additionally, The Nature Conservancy has protected 5,000 miles of rivers and operates 100 marine conservation projects. These areas serve as home to rare and endangered species of wildlife and plants. The Conservancy owns and manages the largest privately owned nature preserve system in the world.

This approach has considerable merit. A private organization can move more rapidly than the public sector. Because it has a limited budget, The Nature Conservancy sets priorities and concentrates on acquiring the most ecologically unique areas. Yet the theory of public goods reminds us that if this were to be the sole approach to the preservation of biological diversity, it would preserve a smaller-than-efficient amount.

Source: The Nature Conservancy, http://nature.org/aboutus/.

二、

The weak sustainability criterion is used to judge whether the depletion of natural capital is offset by sufficiently large increases in physical or financial capital so as to prevent total capital from declining. It seems quite natural to suppose that a violation of that criterion does demonstrate *unsustainable* behavior. But does fulfillment of the weak sustainability criterion provide an adequate test of *sustainable* behavior? Consider the case of Nauru.

Nauru is a small Pacific island that lies some 3,000 kilometers northeast of Australia. It contains one of the highest grades of phosphate rock ever discovered. Phosphate is a prime ingredient in fertilizers.

Over the course of a century, first colonizers and then, after independence, the Nauruans decided to extract massive amounts of this rock. This decision has simultaneously enriched the remaining inhabitants (including the creation of a trust fund believed to contain over $1 billion) and destroyed most of the local ecosystems. Local needs are now mainly met by imports financed from the financial capital created by the sales of the phosphate.

However wise or unwise the choices made by the people of Nauru were, they could not be replicated globally. Everyone cannot subsist solely on imports financed with trust funds; every import must be exported by someone! The story of Nauru demonstrates the value of complementing the weak sustainability criterion with other, more demanding criteria. Satisfying the weak sustainability criterion may be a necessary condition for sustainability, but it is not always sufficient.

Source: J. W. Gowdy, and C. N. McDaniel. "The Physical Destruction of Nauru: An Example of Weak Sustainability," *Land Economics* Vol. 75, No. 2 (1999): 333–338.

（背面仍有題目，請繼續作答）

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三、 In the Tha Po village on the coast of Surat Thani Province in Thailand more than half of the 1,100 hectares of mangrove swamps have been cleared for commercial shrimp farms. Although harvesting shrimp is a lucrative undertaking, mangroves serve as nurseries for fish and as barriers for storms and soil erosion. Following the destruction of the local mangroves, Tha Po villagers experienced a decline in fish catch and suffered storm damage and water pollution. Can market forces be trusted to strike the efficient balance between preservation and development for the remaining mangroves?

Calculations by economists Sathirathai and Barbier (2001), demonstrated that the value of the ecological services that would be lost from further destruction of the mangrove swamps exceeded the value of the shrimp farms that would take their place. Preservation of the remaining mangrove swamps would be the efficient choice.

Would a potential shrimp-farming entrepreneur make the efficient choice? Unfortunately the answer is no. This study estimated the economic value of mangroves in terms of local use of forest resources, off-shore fishery linkages, and coastal protection to be in the range of $27,264 to $35,921 per hectare. In contrast, the economic returns to shrimp farming, once they are corrected for input subsidies and for the costs of water pollution, are only $194 to $209 per hectare. However, as shrimp farmers are heavily subsidized and do not have to take into account the external costs of pollution, their financial returns are typically $7,706.95 to $8,336.47 per hectare. In the absence of some sort of external control imposed by collective action, development would be the normal, if inefficient, result. The externalities associated with the ecological services provided by the mangroves support a biased decision that results in fewer social net benefits, but greater private net benefits.

Source: Suthawan Sathirathai and Edward B. Barbier. "Valuing Mangrove Conservation in Southern Thailand," Contemporary Economic Policy Vol. 19, No. 2 (April 2001): 109–122.

四、 The U.S. Environmental Protection Agency (EPA) was tasked with developing a "maximum achievable control technology standard" to reduce emissions of hazardous air pollutants from iron and steel foundries. As part of the rule-making process, EPA conducted an *ex ante* economic impact analysis to assess the potential economic impacts of the proposed rule.

If implemented the rule would require some iron and steel foundries to implement pollution control methods that would increase the production costs at affected facilities. The interesting question addressed by the analysis is how large those impacts would be.

The impact analysis estimated annual costs for existing sources to be $21.73 million. These cost increases were projected to result in small increases in output prices. Specifically prices were projected to increase by only 0.1 percent for iron castings and 0.05 percent for steel castings. The impacts of these price increases were expected to be experienced largely by iron foundries using cupola furnaces as well as consumers of iron foundry products. Unaffected domestic foundries and foreign producers of coke were actually projected to earn slightly higher profits as a result of the rule.

This analysis helped in two ways. First, by showing that the impacts fell under the $100 million threshold that mandates review by the Office of Management and Budget, the analysis eliminated the need for a much more time and resource consuming analysis. Second, by showing how small the expected impacts would be, it served to lower the opposition that might have arisen from unfounded fears of much more severe impacts.

Source: Office of Air Quality Planning and Standards, United States Environmental Protection Agency. Economic Impact Analysis of Proposed Iron and Steel Foundries NESHAP Final Report. November 2002; National Emissions Standards for Hazardous Air Pollutants for Iron and Steel Foundries, Proposed Rule, Federal Register Vol. 72, No. 73 (April 17, 2007): 19150–19164.