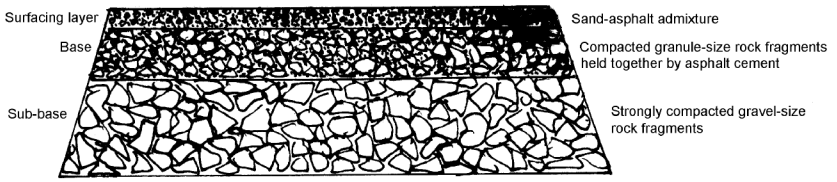

Figure 3. Triple-layered road pavement should comprise (i) strongly compacted gravels or gravel-sized rock fragments, (ii) hotmix base made up of granules or granule-sized rock fragments held together by asphalt, and (iii) top bituminous surfacing consisting of finer sand (0.25–1.0 mm) admixed with asphalt. In the diagrammatic sketch, fine stipples represent asphalt (based on Anon[5]).

the laying of roads without the protective layer at the top (Figure 1). Bereft of the top layer of sand–asphalt mix (*surfacing*), our roads are like a body flesh without its skin. The roads are bound to get 'seriously wounded', as is happening all over India, with few exceptions.

These considerations lead to some questions of far-reaching implication. (i) Have the engineers done away with the mandatory provision of 20–40 mm thick bituminous surfacing made up of sand–asphalt mix? (ii) Is provision of this top surfacing layer made in the design of the roads, and whether this mandatory imperative is spelt out in the tenders? (iii) If the tenders do indicate the provision of bituminous (sand–asphalt mix) surfacing, do the engineers ensure its laying down? (iv) Whether contractors get paid for construction of roads with or without the top surfacing layer?

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NEWS

MEETING REPORT

Ecological complexity and sustainability*

The world is experiencing catastrophic global environmental problems such as climate change, global warming and rise in sea-level. Rapid urbanization, industrialization and globalization have enhanced the pace of these changes, and have exerted severe ecological stress on the earth and its life-supporting systems from local to regional, and global scales. Water shortage, desertification, soil degradation, greenhouse gas emission, elevated sediment and nutrient flux to the coastal seas and other environmental problems are increasingly becoming the common side effects of those human activities. Sustainability can only be assured with an ecological understanding of the complex interactions among environmental, economic, political and social/cultural factors, and with careful planning and management grounded in ecological principles. Ecological complexity and sustainability are becoming a core concept and instrument for improving our common future.

The structure of EcoSummit was unique in the sense that it was a summit and not a workshop or conference, and ensured active participation of all delegates through the Working Groups, in addition to the symposia, oral presentations and poster sessions. The first EcoSummit was held at Copenhagen, Denmark in August 1996.

EcoSummit is being held once in four years to discuss the complex global problems. This year it was held in Beijing. The primary objective of the EcoSummit was to encourage greater integration of both the natural and social sciences with the policy and decision-making community, to develop a better understanding of the complex nature of ecological systems. About 1400 leading environmental scientists from 70 countries met at EcoSummit 2007 to discuss how ecology can help to mitigate global climate change, ecosystem degradation, and to find ways to improve human well-being in the context of the UN Millennium Development Goals.

EcoSummit 2007 included four plenary sessions, 50 symposia, 20 oral sessions, three poster sessions, nine evening sessions and one forum. The plenary session covered topics from ecology in the 21st century, sustainable development, ecoscaping, ecological indicators, urban ecology, ecological engineering, ecological sustainability, ecological traps, ecology-systems approach, microbial ecology, ecosystems services and impacts of invasive species and climate changes. The symposia covered a wide array of topics, including ecosystem modelling, system analysis, invasion biology, sustainable management of coastal lagoons, mathe-

*A report based on EcoSummit 2007 – 'Ecological Complexity and Sustainability: Challenges and Opportunities for 21st Centaury', held in Beijing, China during 22–27 May 2007, jointly organized by a number of ecological societies and associations along with Chinese Academy of Sciences, International Council of Scientific Union and Elsevier Publications.

matics of spatial ecology, endangered species conservation, urban ecosystem management, long-term socio-ecological research, ecohydrology, ecoinformatics, forest management and hydrology, invasion biology and management, and social–ecological systems analysis. Oral sessions comprised topics such as global ecology, agriculture ecology, forest ecology, pollution ecology and ecotoxicology, soil ecology, aquatic ecology and wetlands, population ecology, restoration ecology, marine ecology and coastal management, urban ecology and physiological ecology. Evening session I was mainly focused on students and about how to prepare a manuscript for international journals. It also included topics like vegetation conservation and restoration in eastern Asia, animal behaviour from individual to population, long-term ecological observation and research. The forum was on Beijing International Eco-restoration Forum of Montougou District, Beijing. A field trip had been organized to different eco-restoration project sites of Montougou District. After the field visit, there was a presentation of the work done so far in Montougou District. This was followed by a group discussion for further planning of the eco-restoration project.

Complex global problems such as sustainable development pose new challenges for research and training programmes in science and technology. According to James P. Collins (US National Science Foundation), the 21st century ecology needs advanced cyber infrastructure, research platforms for testing ecological theories on regional to continental scales, and new tools for analysing large datasets. Rusong Wang (Research Center for Eco-Environmental Science, Chinese Academy of Sciences) discussed a new concept of 'Ecoscaping' for simplifying complexity and thus achieving sustainability. He defined ecoscape as a multidimensional complex ecosystem, integrating geographical patterns, biological processes and anthropological dynamics.

Robert Costanza (Director, Gund Institute for Ecological Economics, University of Vermont) gave an informative account of emerging analytical tools and institutions to meet some of the complex problems. Recognizing the co-evolution of humans, their culture and their interactions with the larger ecological system, he described the need for spatially explicit analysis and modelling tools that incorporated social, human (including knowledge) built and natural capital. Such models (e.g. the global unified metamodel of the biosphere or GUMBO) should involve multiple disciplines and stakeholders, and thus act also as consensus-building tools. He also described innovative adaptive management institutions that promise to better manage human activities to achieve societal goals, such as common asset trusts like the Earth Atmospheric Trust. The simplest of ecosystems itself is highly complex in nature and still imperfectly understood. According to John A. Lee (Department of Animal and Plant Sciences, The University of Sheffield, UK), most of the ecosystems have evolved over thousands of years, but have been studied in detail only during the last hundred years. Sustaining the development of economy and society requires building up of the right ecology view and developing ecology civilization; ecological education is just the basic premise and forceful guarantee, according to Ming Angang (Forestry College of Guangxi University, Nanning, China).

Felix Müller concluded the EcoSummit by highlighting the need to integrate insights from various disciplines. Bai-Lian Larry Li (Editor-in-Chief, Chair of the International Scientific Committee of the Summit), presented the Beijing Ecological Declaration, which had been formulated by the organisers, in consultation with representatives of many participating organizations. The Declaration called for more environmentally sensitive development and highlighted the important role of the ecological sciences in tuning policies to that end. Scientists at the Eco-Summit have called for the human society to work together to prevent further ecological deterioration of the earth. This demands developing and enforcing environmental laws and regulations, and upholding and applying international conventions. It also requires the widest collaboration between civil society, government and scientists in applying ecology to everyday life. Ecology is one of the tools we must use in our efforts to make this a better world.

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