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Report to the International Development Research Centre of Canada &
the Chinese Academy of Sciences

Feasibility study for a geographic information system for biological diversity conservation in Xishuangbanna Biosphere Reserve, China

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Executive Summary

This feasibility study explores the prospects for expansion of China's capacities for conservation of biological diversity in its tropical and subtropical biosphere reserves. The discussion focuses on Xishuangbanna Biosphere Reserve, on China's southern border, as an example of how to improve China's capacities to inventory, monitor, and conserve biological resources. A significant aspect of the upgrading of capacities would be increased reliance on computer tools such as geographic information systems (g.i.s.).

Xishuangbanna is one of the most biologically rich areas in China with a complex transitional mosaic of tropical and subtropical rain forest (Zhu 1960, Zhu 1992) as well as distinct cultural landscapes (Yunnan Society...et al. 1992, 114 - 117). The area is already the focus of a number of large international conservation projects and therefore has some advantages as a site for a prototypic g.i.s. The area is well known, high profile, and harbours a strategic portion of China's biological diversity and genetic resources.

This proposal explores a prototype g.i.s. with the following elements:

1. remote sensing data for vegetation mapping and the monitoring of primary forest;

2. inventorying and monitoring techniques of both biophysical and social factors;

3. modelling and simulation of the impacts of land use on vulnerable habitat and elements of local biological diversity;

4. linking inventorying, monitoring, modelling, and simulations through a series of modules and "expert systems" for conservation planning; and

5. the making of such technology available expressly for reserve managers, local communities, and NGOs.

There are three pressing needs for a biological diversity conservation-oriented geographic information system for Xishuangbanna.

1. As a prerequisite to more effective decision-making, it is necessary to better **delineate management zones** as related to the concepts of biosphere reserve cores, buffers, and transition areas. In most cases, more active protection of habitat is necessary. But at the same time, some forms of expanded, though regulated, land use is inevitable, around protected cores. Given the cultural dynamics and population-based pressures for expanded agriculture, such decision-making must be increasingly site specific.

2. It is necessary to more effectively integrate protected area zoning and management with **local knowledge** and traditional livelihoods of local communities. Xishuangbanna has remarkable examples of traditional systems of knowledge and conservation of biodiversity. Unfortunately, the Nature Reserve administration and management has not always supported the continuation and enhancement of these patterns of management and forest conservation.

The g.i.s. for this area should be part of an effort for a locally managed information system, that can be eventually appropriated from bureaucrats oriented to provincial and national administrative culture.

3. The third imperative for improved land management capacities is for the better monitoring, conservation and procurement of **genetic resources** particularly species in crop gene pools and medicinal species. Given the tremendous wealth in the remaining forest fragments of Xishuangbanna, and the often relatively densities of populations and occurences, a g.i.s. for the area holds the promise of being highly precise across a number of scales. And the use of better monitoring techniques and g.i.s. technology would allow conservation to better contribute to society-wide economic development through providing germplasm for biotechnology ventures and with sites for related research. Both of these goals are embodied in the *Convention on Biological Diversity* and this project has originally envisioned as a key prototype for implementation of the Convention, as related to the genetic resources, both within China and in other biosphere reserves in the international network.

Background and problem statement

The growing global concerns for the conservation and utilization of biological diversity and genetic resources is stimulating the development increasingly sophisticated and powerful data bases. In order to make better land management decisions, which can be carefully integrated into development planning, spatial data bases, such as geographic information systems (g.i.s.) are necessary. As natural habitat has dwindled to small fragments, conservation planning in China has become increasingly site-specific. There is less and less room for anything but a careful balancing of protected habitat, tourist facilities, regulated agriculture and limited collecting of genetic material. The problem this project addresses is the need to develop biodiversity conservation-oriented data bases which are tailored to the decision-making contexts of particular nature reserves of China. Such g.i.s. facilities can function to stimulate the linkages between habitat protection and sustainable development (Chen 1993). Xishuangbanna Biosphere Reserve, in southern China, is particularly rich in biodiversity but its tropical and subtropical forests are increasingly under threat (Institute of Ecology and Geobotany 1993). A more precise basis for land management and habitat monitoring is needed particularly for dealing with questions of land management by minority communities (Chen 1991, 1992).

I was originally invited to China in 1989, as a Canadian Ph.D. student at Berkeley, and in 1991 conducted a reconnaissance of some biosphere reserves funded by the British Columbia Scholars in China Program under the auspices of the Man and Biosphere Programme of China (MAB China) of the Chinese Academy of Sciences (CAS) and The University of British Columbia (UBC).[1] Subsequently, a collaboration was proposed between CAS and UBC with support from the

[1] The 1991 visit was hosted by MAB China and involved reconnaissances of Dinghusan and Fanjishan Biosphere Reserves.

IDRC.[2] I was asked by CAS and IDRC to develop a proposal for collaboration between CAS, UBC, and IDRC. This complete proposal was originally to be completed by mid to late 1993. However, serious problems became evident. The most serious obstacle was the unwillingness of MAB China to cooperate with other units of the CAS, ones that have had a much longer history at developing g.i.s. for nature reserves and working with local land managers.[3]

In the 1991 to 1993 period, I compiled information on Fanjingshan and Dinghushan Biosphere Reserves. However, in May of 1993, MAB China insisted that a pilot project quickly be developed for Xishuangbanna Biosphere Reserve, one that I had not visited. But there was no money left from the original IDRC seed grants, most of the money having already gone to CAS, in order to conduct the necessary reconnaissance. Coincidentally, while in Beijing in 1993, I was informed, by fairly reliable sources that wish to remain anonymous, that there were already two other international projects in Xishuangbanna which appeared identical to the one requested by the MAB China unit of the CAS. And it become evident by mid-1993, there would be no funds available from IDRC for minimum levels of UBC participation. Given that the human resources for the project were being provided by UBC for free, up until this point, work on the proposal was deferred and eventually cancelled.[4] In fact, the accompanying reports recommend against Canadian

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[2] There was slightly over $20,000. provided by the IDRC in 1992 and 1993 for UBC to service the CAS. However, it became evident, by late 1993, that there were insufficient funds from the IDRC to fund UBC participation on an ongoing basis. In addition, it became evident that there were problems with the unit within CAS, the China Man and Biosphere Program (MAB China). After a Unesco-IDRC visit to UBC, from five individuals associated with that unit of CAS in the summer of 1992, it became evident that there were major discrepancies in the goals and practices of CAS personnel. Considerable animosity was exhibited between the personnel from the south China reserves and the administrators from Beijing. Those individuals were:

1. Zhao Xianying, Secretary-General of the China MAB (Man and the Biosphere Programme) National Committee (Chinese Academy of Sciences, 52 Sanlihe, 100864 Beijing China, fax +86 1 80 11 095)
2. Zhao Yong, China MAB National Committee (Chinese Academy of Sciences, 52 Sanlihe, 100864 Beijing China, fax +86 1 80 11 095)
3. Sun Dunyuan, Research Director, Fanjingshan Biosphere Reserve (Fanjingshan Nature Reserve, China Department of Forests, Jiankon County, Guizhou Province 554400 China, telephone: +86 851 177)
4. Xie Zhi Xin, Director, Wuyishan Biosphere Reserve Fujian Wuyi Mountain National Nature Reserve (Sangang, Wuyishan, 354315 Fujian, China, telephone: +86 32382)
5. Zhang Quanyi, Director, Shennongjia Biosphere Reserve (Shennongjia Nature Reserve, Muyu Town, Shennongjia, Hubei 442421, China)

[3] For example, there had been virtually no contact between MAB China and the recently formed Biodiversity Committee of the Chinese Academy of Sciences nor the CAS Laboratory of Quantitative Vegetation Ecology headed by Professor Chang Hsin-Shih. Both offices are blocks away from those of MAB China in Beijing.

[4] The remaining time put into completion of the reports, over 100 hours, by myself was through personal time separate from UBC-funded responsibilities.

funding of projects with MAB China until some basic conditions for cooperation, efficiency, and accountability are assured.[5] This report is one of several written for the benefit of the IDRC and other agencies involved with biodiversity conservation and the related used of geographic information systems in China.[6]

The biosphere reserves of southern China

The biosphere reserves of subtropical and tropical, southeast Asia are under tremendous pressures from liquidation of remaining forest from logging, intensifying shifting agriculture, and modern agricultural expansion including both plantations and peasant farmers. In addition, the network of designated protected areas is not being adequately managed to maintain vulnerable species and those with genetic resources. There are few examples of successful and comprehensive conservation of biological diversity and genetic resources for any district in the region. The six biosphere reserves in southern China are part of a broader national system of Nature Reserves (Li Wenhua and Zhao Xianying 1989).[7] But only these six internationally recognized areas are part of the Unesco-affiliated network of biosphere reserves. Launched by Unesco in 1971, the Man and the Biosphere Programme (MAB) is an interdisciplinary research programme aimed at providing a scientifically sound foundation for the use and conservation of natural resources. Given China's isolation in past decades, the guiding principles of the International MAB Programme contributed significantly to the development of national research programmes on biological conservation. In order to strengthen its working relationship with the international MAB Programme, China established its own national committee[8] for MAB in 1978.[9]

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[5] This situation was outlined verbally to Stephen Tyler of IDRC Singapore in 1993.

[6] For an overview of the policy questions that emerged from the aborted CAS-UBC-IDRC collaboration, see the accompanying, **Final report on a joint IDRC - Chinese Academy of Science - University of British Columbia Project, Geographic information systems for the conservation of the biological diversity of biosphere reserves of China**.

[7] In this document, "nature reserve" and "biosphere reserve" can be used interchangeably. In China, a "Nature Reserve" is the equivalent of the more commonly used protected area term, "National Park" Nature reserves represent the best-protected natural areas in the country. A subset of the Nature Reserves of China have been nominated and approved as Biosphere Reserves under Unesco's Man and the Biosphere Programme. In contrast to World Heritage Sites, which involve a convention by the title, expectations of what constitutes a biosphere reserve are flexible though focus on a commitment to protection and monitoring of ecological processes and biological diversity and access by foreign scientists who historically, have often been involved in comparative studies. In the Chinese context, a nature reserve's additional status as a biosphere reserve allows for easier access by foreign scientists in terms of permits.

[8] MAB China's governing body consists of members representing ten state ministries on resources, environment, science, education, etc.; leading scientists in the fields of resource and environmental sciences; and 8 National Academic Associations.

[9] The Committee is part of the Chinese Academy of Sciences and is responsible for carrying out the MAB programme in China.

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In recent research to further develop the MAB Programme, the China MAB Committee selected five key fields of inquirey:
forest ecosystems,
urban ecosystems,
ecological agriculture,
ecosystems of arid and semi-arid zones, and
nature conservation.
MAB China set up specialized groups for each area to promote and advise on research, training and publications. International organizations and governments have contributed to China's research in the field of natural resources and the environment. For example, the Cooperative Ecological Research Project (CERP) is jointly sponsored by China, Germany and UNESCO. The main phase of CERP has been carried out successfully. Another important task of the MAB China has been to produce publications for the benefit of scientists, decision makers, administrators, educators and the general public. As an international "channel" and "window", the Chinese MAB Committee lays particular emphasis on serving as a link between China and other countries. Over the past decade, China has increased its number of nature reserves from 100 to over 700. These reserves play a central role in the conservation of natural habitats and genetic resources in China. However, the coordination of resources for management of all the reserves, and research operations, has been weak. The Reserve manager is a powerful local official with few responsibilities set by Beijing and their involvement in the MAB China network is strictly voluntary.

The six biosphere reserves of subtropical and tropical China represent a wide range of ecosystems and management needs as related to the conservation of biological diversity. Even with its huge population, China is still rich in flora and fauna and her diverse natural conditions have given rise to a wide variety of biotic types and species. The most immediate social value of the biosphere reserves of subtropical China are for tourism and recreation. In addition, there is significant harvesting of wild plant and animal species, some of which have disappeared elsewhere, and a substantial portion of this is at unsustainable levels. Unfortunately, roughly a half billion people are living in the subtropical and tropical areas. Their lives depend both on natural products and the agricultural use of formerly natural areas. This contradiction is reaching crisis proportions in the biosphere reserves of southern China.

Scientific questions in strategies for conservation of biological diversity in southern China

The following are the major theoretical questions in this feasibility study. These relate to the linking of conservation planning theory, land management, and data base architecture.

1. How can this high level of biological diversity, much of which is under threat, be most efficiently monitored?

2. How can the impacts of agriculture, gathering, and hunting in order to better determine the spatial boundaries of management areas and carrying capacities be best modelled?

3. How can trade-offs between spatial aspects of management prescriptions, and the nature and intensities of interventions and regulation of land use activities, be fully identified?

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4. How populations with genetic resources be best identified for the purposes of
a. more effective conservation,
b. procurement of germplasm, and
c. cooperation with national efforts for biotechnology research and development?

These questions are highly technical, however, they have tremendous policy implications for bilateral cooperation especially with the advent of the *Convention on Biological Diversity* of which China and Canada are both signatories.

There are few examples of integration of conservation of biological diversity within development contexts - particularly in terms of real indicators of social benefits. There are also few examples of generation of multiple options for conservation and development and related trade-off analysis. From a global perspective, biodiversity conservation research in southern China provides some key opportunities because of the great number of economically important wild species, the relatively high quality of data on the distribution and status of populations of rare species, and improving levels of education.

Xishuangbanna Nature Reserve: An overview

"It is one of the richest and most lovable tropical and subtropical regions in China. (Zhu 1960)

Xishuangbanna literally means the twelve counties and reviews to the remoteness of this region in Ming China. Its forests were and are renowned as some of the most rich and magnificence in China. Xishuangbanna is also the home for 4 minority groups: the Dai, Hani, Gino, and Yiao. There are 20,000 people living in the 5 core areas and a total of 650,000 in the 5 districts that comprise "Xishuangbanna."

The Dai are lowland rice farmers and live up to between 800m and 1,000m elevation. The other groups live on mountain slopes at higher elevations, cultivate rice and corn, and are involved with shifting cultivation. The Yiao are particularly involved shifting agriculture and their major crop is corn. There are also some Han communities, displaced from other parts of Yunnan and Sechuan provinces, who engage in shifting agriculture. In recent decades, with considerable pressure from the government, forest has been permanently cleared for rubber plantations. This policy was finally curtailed in 1992 when the government finally realized that loss of rainforest could limit the growth of the area's burgeoning (eco)tourism industry.

The area is renowned for its traditional forms of forest conservation. As based on traditional religious beliefs, overlaid with Buddhism, the Dai minimize the cutting of primary forest and plant forests around their villages. These forests are the source of firewood. Perhaps the most intriguing are the Gino who live on the slopes of a ridge often referred to as Gino Mountain. Canopy is never cut but medicinal plants are cultivated in the understory.

While Xishuangbanna is remarkable in its social potentials for forest conservation, there are serious problems. The local population is growing rapidly. Tourism is expanding rapidly. The potentially increased contact with neighbouring Thailand and Burma could lead to increased poaching and rural migration into the area. Fortunately, the Yunnan Ecology and Geobotany

Institute has been working in the area since 1950. In recent years, there have been substantial achievements in better inventory of the biological diversity of the area (Xishuangbanna...1987). There has been some support for research, mainly on vertebrates, especially from the World-Wife Fund for Nature (WWF).

Some objectives for expanded g.i.s. for conservation and land management at Xishuangbanna

The function of the project would have been to support MAB China in order to develop and promote the use of biodiversity conservation planning utilizing geographic information systems. The project would have been workable for the Landscape Ecology GIS Lab of UBC if there had been an opportunity to conduct basic research related to conservation biology and landscape ecology as part of development of the data bases for particular areas. In order to do this, a prototype have been necessary. Questions of strategies for compilation of data and monitor the flora, fauna, genetic resources, and cultural landscapes of a particular biosphere reserve would have been explored. This could have contributed to improvement of the management of reserves and more sustainable utilization of local plants and animals. It would also have given scientists further opportunities to monitor populations with genetic resources.

The following are some of the long-term operational objectives that would have been worthwhile for the project.

1. A g.i.s. usually has both data retrieval and calculation capacities and these could be developed to determine possibilities for the sizes and boundaries of the core, buffer, and transition areas[10] of the biosphere reserve.

2. Software modules could have been development that would have linked data on conservation requirements and options for integration of conservation with regional economic development consistent with the principles of adaptive management.

3. The current knowledge bases of these biosphere reserves, into multiple layers of maps, could have been compiled in a digital format.

4. In order to support these relatively technology-intensive activities, it would have been necessary to develop new training programmes on biodiversity conservation and g.i.s. that probably would have involved components in Canada, Beijing, and in the biosphere reserve.

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[10] The core, buffer, and transition trinity is an essential concept of the biosphere reserve network. Cores have very little human-induced disturbance though regional and global changes appears to be increasingly unavoidable. In the buffer areas, there can be some active land use but it must be regulated to minimize deleterious impacts on ecosystem functions and local biological diversity. The transition areas are essentially those within the district or region which cannot be conserved but which have direct impacts on conditions within the buffer and core areas and which, therefore, will need close monitoring and possibly regulation.

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Social benefits

The project was to be carried out by Chinese and Canadian researchers on a cooperative basis. In turn, managers would have had additional training in supervision of personnel and field work, data compilation, and computer analysis. This could have contributed to the improvement in the living standing of local people through contributing to land management decisions that reversed the destruction of biological resources and local life support systems. Through more highly site-specific decision-making, under the supervision of scientists and reserve managers, the rapidly decline in regional environmental quality in these areas of southern China could have at least been slowed. But more importantly, given the relatively small portion of the land base of these nature reserves, the prototype g.i.s.-biodiversity conservation methods could have been educational and political models for more ecosystem-based approaches in other areas.

The initial phase of the activities of the project would have involved the following progression of activities:

1. development of a rudimentary geographic information system for Xishuangbanna Biosphere Reserve;

2. assessment of options for conservation of biological diversity involving delineation of management units and the formulation of options for management prescriptions;

3. compilation and entry of the data on the biosphere reserve into computerized maps;

4. creation of geographic information systems modules for various spatial calculations with subsequent simulation and identification of options for "sustainable" conservation and development;

5. training of Chinese scientists and development of a basis for teaching conservation-oriented geographic information system procedures, and use of respective technologies;

6. establishment of g.i.s. capabilities in both Beijing, for MAB China, and in Banna for more effective conservation decision-making for Xishuangbanna;

7. technical meetings in China on:

a) geographic information systems architecture (systems design) for biodiversity conservation planning;
b) spatial data review, compilation, and computer entry;
c) integration of local knowledge and assessment of local conditions and needs into biodiversity conservation planning (and geographic information systems); and
d) use of geographic information systems for integration of conservation planning into efforts for "sustainable development."

8. stimulation of publications and scientific articles on the biological diversity of southern China, its status as well as that of respective forest ecosystems, and the potentials for linkages between conservation and economic development.

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Implications of the *Convention on Biological Diversity*

Both China and Canada were some of the first signatories of the Convention. The IDRC is the Canadian agency charged with fostering implementation of the Convention outside of Canada. A g.i.s. for a south Chinese forest area would have functioned as a prototype for other protected areas in China and for the use of spatial data in implementation of the Convention - both in terms of conservation and utilization of biological resources.

The most immediate contribution to the implementation of the Convention would have been in:

1. facilitating the international exchange of information for the development of new conservation efforts and respective prioritizing and

2. allow for more precise and effective *in situ* conservation of wild species with genetic resources and for identification and procurement of germplasm.

The most available network for transmission of this information, both within China and outside of the country, would have been the Unesco Paris-basis MAB programmes.

Functions of the biodiversity conservation geographic information system for Xishuangbanna

Having never being funded to go to Xishuangbanna, I am at a loss to consider how to tailor such a prototype g.i.s. to some rather unique conditions. It is safe to characterize the needs of such a g.i.s. as being dominated by the following factors:

- the high level of biological diversity particularly associated with the remaining fragments of primary and relatively intact forest;

- the remarkable cultural aspects of the local landscape ecology as related to a range of social factors from religion, traditional tenure, and the political upheavals of the Twentieth Century;

- the need to monitor, as the basis for development of land management frameworks, that produce satisfactory compromises for a number of groups, from local landowners to the government agencies, with overlapping jurisdictions; and

- the relative instability of the region, in terms of management controls, given its proximity to other southeast Asian countries and to the "Burmese Triangle."

In beginning the g.i.s., data would have been gathered from existing information in the Chinese Academy of Sciences, the local institutes[11], and field work. The field team will be

[11] Local research institutes of China, even when affiliated with CAS, do not seem to be under any regulation to freely share information and there was never a strategy of how to approach respective offices for their cooperation. It would have been difficult and expensive.

composed of scientists from cooperative institutions and local managers and scientists. The following steps are the major components in the data collection methodology:

1. compilation of current species lists and sensitive and valuable species;

2. map data of key species;

3. linkages with mapping of horizontal attributes with requirements for habitat;

4. identification of information gaps in terms of species and spatial data;

5. verification of the structure and various aspects of cause and effect linkages between impacts of land use in buffer zones and population viability; and

6. simulations to ascertain options and strategies for secure and sustainable conservation and for some expanded land use in buffer zones.

Institutional capacities and personnel

Data in Beijing suggested that Xishuangbanna nature reserve agency involves has around 40 permanent scientists and 10 administrators who reside in either the nature reserve facilities or in the town of Banna. In the regional city, Kunming, there is Yunnan Institute of Ecology and Geobotany. The institute is associated with the Chinese Academy of Sciences, has about 18 staff scientists and library facilities. The Chinese Academy of Sciences (CAS) is the national academic research body on natural sciences in China. CAS has over one hundred institutions all around the country with more than 20,000 scientists. In order to carry out this project, some related institutions would have been asked to cooperate with the Biosphere Reserves in China on the research, notably the Commission for Integrated Survey of Natural Resources, the South China Institute of Botany. Some of the sub-projects will also be done with the help from universities in China.

As of 1993, eight nature reserves had been recognized as part the Biosphere Reserve Network. The Chinese MAB National Committee is responsible for negotiating cooperative agreements between all the China nature reserve administration offices and with other institutions both in China and abroad. The daily operations of the MAB Secretariat are supported by the Chinese Academy of Sciences. Unfortunately, as of the end of 1993, the CAS staff assigned to MAB China appear to have shrunk from 7 to 5. MAB China has no formal jurisdiction in a biosphere reserve. However, this additional label for a nature reserve makes access to foreign scientists significantly easier - for a rapidly rising price. The first involvement of MAB China in a g.i.s. project was with Federal Republic of German-supported project for Changbaishan Biosphere Reserve, in the northeast. The project was part of the Cooperative Ecological Research Project (CERP) which is currently in its second phase[12]. The Changbai project involved a ARC|INFO data

[12] The CERP programme began in 1987 and in the 1987-90 period there were 8 subprojects at a funding level of US$ 2.5 M. In this second phase, the funding level is at US$ 1.4 M and involves 3 subprojects. The programme is administered as a funding trust between the German Federal Ministry of Research and

base and was initially developed near Munich at the headquarters of ESRI Germany. The data bases is now housed at the Shenyang Institute of Ecology. This data base was largely an inventorying and vegetation mapping tool which was not sufficiently oriented to conservation of biological diversity and finer-scaled aspects of land management.

In recent years, there has been a modest beginning to identify more rational management boundaries for Wuyishan Biosphere Reserve and use in fire protection involving the ITC, the International Institute for Earth Sciences and Aerial Surveying, of the Netherlands. The project is named "Information Service for Environmental Planning and Decision-making for Sustainable Development of the Wuyishan Biosphere Reserve (WBR)" and has been carried out in conjunction with the Commission for Integrated Survey of Natural Resources, Chinese Academy of Sciences. In addition, there have been recent efforts to establish a g.i.s. for the renowned Woolong Biosphere Reserve with its populations of giant pandas.

Policy, administrative, and technical recommendations

Bilateral recommendations

- For bilateral projects involving biosphere reserves in China, negotiations, and subsequent agreements, should be developed both at higher levels of the CAS than at MAB China, and directly with the chief administrators of the respective biosphere reserve / nature reserve.

- The roles of participating Canadian universities and their relationships to Canadian international agencies must be established, clearly, before negotiating with Chinese authorities. Without this, the Canadian university is vulnerable to the "hijacking" of projects by unscrupulous (Canadian) bureaucrats looking for indirect subsidies to expand their shrinking funding bases. More importantly, Chinese administrators seem to be almost looking for inconsistencies between agencies of the same foreign country in hopes of "playing them off" each other for their own fortunes.

- While support for United Nations networks such as MAB is often worthwhile, many of these administrations and international bureaucracies remain corrupt and ineffective. Support for international linkages, by donors, can often be more efficiently directly at non-governmental organizations both within and outside of countries such as China and a full review of potential collaborators should be a key element in project development.

Administrative recommendations

- Where a Canadian university agrees to accept a grant from IDRC, particularly where it is to service programmes for which IDRC will receive much of the credit, the full extent of the transactions and obligations must be clearly stated. If, for example, a seed grant is used to develop a project where there would then be unworkably low levels of funding for that university, there should be a clause for the university to cancel its remaining obligations or to

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Technology, Unesco and the CAS with Unesco receiving a 13% overhead for some of the administration.

seek compensation for what amounts to substantial subsidies to IDRC.

- Where a Canadian university agrees to accept a grant from IDRC, standard university contract administrative fees should be used unless there is a written agreement clarifying the actual funds and research opportunities that will be afforded for that university. To put it bluntly, there needs to be safeguards to protect Canadian universities from being "ripped off" for ideas, information, services, and personnel.

- The May 1993 MAB China request to quickly change the sites for the feasibility study amounted to a sabotaging of the prospective CAS-UBC link. This was at a time, not coincidentally, when IDRC was reevaluating the moneys and percentages available to Canadian universities and when it was clear to the Chinese hosts that they no longer needed UBC support to receive additional IDRC funding. The sites of case studies should be formally negotiated months and years before a written product is due.

Technical recommendations

- Case studies on biodiversity conservation geographic information systems require extensive field work and contact with local officials early in the development of proposals and reports.

- As part of the early phases of proposal development and feasibility studies, the actual quality of the spatial and other ecological data must be accessed in conjunction with field tests.

- The prospective land and data base managers must be interviewed extensively, early on, in order to assess their needs and capabilities in actually being in a position to use such data-intensive conservation tools.

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