The Common Property Resource Digest

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This issue of the CPR Digest begins a series of CPR Forums on sub-themes of ***The Commons in the Age of Globalization***, the 9th Biennial Conference of the IASCP (see the announcement and call-for-papers starting on page 14). We focus on theme # 5, new analytic tools for CPR management. We are also excited to present this Forum in combination with our first South Asia Regional Beat, edited by **Riya Sinha**.

The combined Regional Beat and CPR Forum begins with a commentary by *Sharachchandra Lele* who sketches the dual dilemmas of "pixelising the commons" and "commonising the pixel." Then four of Lele's South Asian colleagues respond. *J. Bandyopadhyay and M. Mandal* ask how the new technologies will affect the use of the traditional knowledge base as they look for the emergence of the barefoot GIS brigade. *Anoja Wickramasinghe* reflects on the tensions between highly technical IT and the cultural basis of much current CPR management. *Riya Sinha* agrees that the new technologies have great potential, but wonders how about their fit with management institutions and fears that they will lead to an overemphasis on things that are easy to map. *Astad Pastakia* finishes up the Regional Beat by calling us to pay attention to the ways in which different groups stand to gain or lose from the new technologies. Two CPR Forum responses from other global regions conclude the discussion. *Ignatius Mberengwa* express optimism that the new technologies will provide great benefit while their problems can be overcome. Finally, *Olivier Petit* explores a particularly innovative technology that combines geographical and social information.

We are also pleased to present a Practitioner's Profile of the Society for Research and Initiatives for Sustainable Technologies and Institutions provide by *Anil Gupta*. **Enjoy!**

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"Pixelising the Commons" and "Commonising the Pixel": Boon or Bane?

Sharachchandra Lele
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"The divide between ecology and economics can be bridged through RS/GIS technology"

> Statement by an environmental scientist at a recent round-table on interdisciplinarityorganized by the Indian Society for Ecological Economics

The information technology (IT) revolution of the past decade has coincided with a revolution in spatial IT on all three fronts: imaging, positioning, and processing. Advances in imaging or remote sensing (RS) have made available high-resolution satellite imagery at fairly accessible prices, almost rendering traditional aerial photographs obsolete. Hand-held global positioning systems (GPSs) are not only affordable but now are able to indicate position within 10m accuracy or better with the removal of "selective availability" (a euphemism for manually-induced noise) in May 2000. And powerful geographic information system (GIS) software are now available on PCs that are themselves becoming simultaneously faster and cheaper. No wonder then that "RS/GIS technology", as this combination of spatial IT is better known, is the 'in thing' today not just with geographers, but also

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ecologists, environmental scientists, even some social scientists, and certainly with planners and managers in departments of forestry, watershed development and agriculture. And the fact that India has been at the cutting edge of commercial satellite imagery in recent times has perhaps lent added visibility to this technology in the South Asian region.

How and to what extent can these technologies, this "pixelisation of the commons", realistically "bridge the divide between ecology and economics" or (more modestly) contribute to CPR research today? And to what extent can the adoption of these technologies in CPR management, i.e., the "commonisation of the pixel", be socially beneficial? I discuss these questions with special reference to the South Asian region, which is characterised by much higher population densities, more intense use of land resources, higher diversity in vegetation and land-use, and incomplete and out-of-date information on tenure as compared to (say) the USA or even the Amazon region where RS/GIS technologies have been developed and most intensely applied.

In theory, the primary contribution of RS/GIS technology to CPR research is to detect the dependent variable, the "condition of the resource", objectively, accurately, precisely, comprehensively and repeatedly. RS/GIS can help researchers integrate information on some explanatory variables such as tenure, soil condition, land-use in non-CPR lands, and proximity of towns or roads. Finally, resource users or managers could use RS/GIS as a planning and monitoring tool, and for the mapping and legitimisation of tenure.

Pixelising the commons

Remote sensing undoubtedly provides a "true-to-life" picture of the resource, a picture that often gives the lie to official statistics, as the study by the National Remote Sensing Agency on deforestation in India did back in the 1980s. But the interpretation of this picture is always a value-loaded exercise, driven by perceptions of what environmental or social value is desired. Ignoring this fundamental fact endows RS/GIS outputs with a false aura of objectivity and a tendency to use information classes in a careless and misleading manner. E.g., the Forest Survey of India claims to map forest cover but actually maps tree cover of all kinds, including that in farm forestry and coffee plantations.

In terms of interpretational accuracy and finer distinctions in information classes, there is no doubt that the higher resolution data available today have improved our capacity to identify certain land-uses, particularly in the South Asian context where land-use parcels can be very small. E.g., in forest maps of the Western Ghats region prepared by the French Institute, Pondicherry in the 1980s using Landsat MSS data of 70m resolution, betelnut plantations were routinely merged with forest; these can now be distinguished IRS-1C (24 m resolution) data in most cases. But increased spatial resolution cannot do much to resolve spectrally similar classes other than providing textural information. E.g., separation of forest from coffee and of harvested cropland, abandoned cropland and grassland are major challenges, as the work of Moran and others in the Amazon, that of Billie Turner and his colleagues in the Himalayas, and by this author in the Western Ghats shows. This separation might only be possible, if at all, with multi-season data, or with hyper-spectral or radar images, all of which are very expensive propositions. These limitations of RS are not well advertised, and the tendency is to work with what can be distinguished rather than what should be distinguished.

Comprehensiveness has two advantages. The first is in the context of micro-level studies, i.e., those involving single or a few villages, which form the bulk of CPR field research. In such studies, an aerial photograph or a satellite image can provide information on landscape-level processes that may be masked or missed out in field sampling, such as the possibility that communities protecting one forest patch might be degrading other patches further away. Secondly, the combination of high resolution data, wide coverage and GIS-based integration has now opened up the possibility of moving CPR field research to the "meso-scale", by conducting multi-village analyses using secondary data on tenurial, socio-economic and biophysical variables. This has been attempted with some success by researchers from the IFRI group at Indiana University in Nepal and this author in the Western Ghats. But the absence of upto-date and geo-referenced village-wise information on important variables such as tenure and soil quality will be a major bottleneck for South Asia. The problems of geo-referencing of satellite imagery itself need greater attention: in even moderately hilly terrain, IRS-1C LISS-3 data (of 24 m resolution) may have geo-referencing errors of up to 50m, unless one carries

out highly sophisticated corrections using accurate digital elevation models, which are again an elusive input.

Repeated imaging is important at one level, as it gives multi-season data, although purchasing multi-season data is not an easy proposition. But perhaps the most important requirement for CPR research is longer time-series data that enable estimation of change in resource condition over several years and decades. Here, satellite imageries are available only from 1972 onwards, from different satellites and at much coarser resolution, making comparisons difficult. On the other hand, aerial photographs are available from at least the 1970s in India or earlier in Nepal at a resolution comparable to the highest satellite resolution available today. Fully exploiting the potential of archival aerial photographs would, however, require getting over the recent technological bias against aerial photographs and the much greater institutional restrictions on access to these valuable historical records that prevail in most of South Asia.

Commonising the pixel

The potential role and contribution of RS/GIS to CPR management is much more ambiguous and double-edged. As it stands, given the cost and complexity of the technology and the scale and resolution at which the data are produced, there appears little incentive for village-level institutions to use RS/GIS. Centrally located planners and project managers, however, find that these technologies increase the apparent comprehensiveness of their planning and the apparent objectivity, reach and accuracy of their monitoring. And donors are usually in favour of high-tech, funds-consuming, consultancy-requiring solutions. In the process, the much slower, obviously subjective and 'low-tech' approach of participatory project monitoring gets relegated to the background. Thus, at a time when the thrust of policy reform in CPR management in the region is ostensibly towards greater decentralisation, these technologies might ironically strengthen the forces of centralisation.

Admittedly, these technologies have also significantly empowered the so-called counter-mapping movement, a label for a host of independent efforts in Canada, Central and South America, the Philippines and Indonesia that involve working with indigenous communities to map their memories of ancestral rights and to understand and represent their alternate perceptions of the landscape itself through a bottom-up and participatory process (see Forum in the May 1998 issue of CPR Digest). Indeed, counter-mapping is seen as a way of mobilising communities to re-map CPRs and then to manage them. But counter-mapping seems not to have gained much momentum in the South Asian region. Perhaps this is because, given historically mixed ethnicities, the concept of "indigenous communities" and their "ancestral rights" is not easy to articulate here. Or perhaps it is because of the much tighter control exerted by the state over maps and over the process of mapping in this region. It may be noted that the impetus for counter mapping has often come from the acceptance by the state of the need to re-map, be it because of court decisions in Canada or legislated mandates in the Philippines.

What has been experimented with in this region is participatory resource mapping (PRM), which is done in collaboration with the state machinery, possibly mediated by researchers. Examples can be found in some community forestry sites in Nepal and in the panchayat-level planning experiment in Kerala state in India. While both experiments have drawn some positive responses from villagers, in the absence of independent evaluations, it is not clear whether these efforts provide genuine autonomy of expression to the villagers, whether the maps provide truly meaningful input to planning, and whether the use of RS/GIS technologies in particular is cost-effective and feasible. As of now, the null hypothesis that RS/GIS technologies can add little value to villagers' intimate knowledge of their landscape remains to be disproved. And this hypothesis cannot be systematically tested until the framework of CPR governance provides sufficient space and autonomy for local villagers to take decisions regarding the resource, after which they can evaluate the contribution of any technology to the quality of their management. Till this radical change occurs, one should not expect the tail of RS/GIS to wag the dog of CPR management. And CPR researchers should explore and exploit these technologies without getting misled by the hype.

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RESPONSE

CPRs Are Waiting for the Barefoot GIS Brigade

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The emergence of the remote sensing (RS) and geographical information system (GIS) has opened up new avenues and options in the monitoring and management of CPRs at all scales. Much of the current literature that has evolved around management of the CPRs in India is on the social and institutional dimensions. The potentialities of RS/GIS technologies in addressing management challenges in them have largely taken a back seat. The article by Lele on the prospects and limitations of the application of RS/GIS on the management of CPRs in the South Asian context addresses this gap and provides very useful information about this rapidly evolving technology.

The article is divided in two parts, one described as the 'pixelisation of the commons', and the other, as the 'commonisation of the pixels'. The first aspect deals with the prospects of wider application of RS/GIS technology in research related to the CPRs, while the second one aims at evaluating the feasibility of their application in their management. The first one is more related to the hardware developments, while the second one deals with the institutional aspects of CPRs.

Right from the beginning, the use of RS technologies have grown to be most appropriate for an overall understanding of large areas. It is believed that the application can be most fruitful at the macro and meso levels which would eliminate detailed field study, and hence, the associated expense of time, money and energy. This situation has changed significantly over the past few years. With reference to the small landuse parcels in South Asia, Lele has correctly appreciated the increasing prospects of the higher resolution of remotely sensed data in the identification and distinction of land uses in smaller spatial units. This is equally useful in cases where spectral similarity had classically posed a problem in the separation of neighbouring patterns of vegetation. However, another factor that may prove to be a major limitation for the use of GIS in CPR management in India is lack of accurate and adequate spatial information, like maps. Such maps at the village level are not readily available in India, while restricted availability of available maps for some areas often adds to the difficulties. However, with the spread in the availability of internet facilities even in remote areas, the difficulties in obtaining maps may surely be lessened.

The possible use of the versatile and multidisciplinary RS/GIS technologies would be different in the case of diverse CPRs, like urban commons, air, water resources, fisheries, forests, grazing lands, biodiversity etc. and of course the global commons. For example, in addressing the management of common water resources in the dynamic context of an upland watershed, GIS techniques have been very successful in providing the stakeholders with a holistic picture and important information on the commons, thus promoting resolution of potential conflicts. Similarly, RS technologies have been very effective in monitoring the movement of polluting substances in larger commons, whether the air or the rivers.

It is here that one has to address the question, how much the RS/GIS technologies can be made economically accessible and user friendly in countries like India. Lele has called this process the 'commonisation of the pixel'. However, he presents a rather conservative picture of the prospects of these information technologies in rural India. Citing the preference of the donor organisation for modern information technologies, as a direct implication of this, he concludes that the technologies may instead of reversing, accelerate the tendency for centralisation. Further, these technologies might not strengthen or build upon people's own knowledge. In such a case question can be raised about the interest that rural institutions may have in using the technology.

It is, however, not clear from Lele, how the traditional knowledge base is going to successfully address the management of the CPRs in the context of increased number of stakeholders, both from the point of view of number and types. As the resolution of these technologies goes up and the price comes down, it may become an essential tool for addressing the management of CPRs quickly and easily. The task is not to underestimate the potentialities of the 'commonisation of the pixels', but to reduce the waiting period for the emergence of the brigade of barefoot experts who would be able to handle and design innovative applications of RS/GIS technologies on the CPRs.

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Challenges for CPR Management

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The whole paradigm of CPR Management is marked with innovations and transitions. The common use of various properties has been evolved in relation to human contacts where common or collective interest towards management has emerged. The private and state property regimes have been established to promote specific ownership authority and control over resources. The acquisition of CPRs by the state has lead to conflicts, initially due to the exclusion of conventions, social systems, regulatory measures and indigenous technologies that have promoted various management regimes. In spite of conceptual problems, a tremendous pressure on conventional regimes has been emerged with modern inventions.

The idea of a CPR endorses collective and cooperate group property where management is done through socially accepted leadership and regulatory measures. The extent to which Information Technology facilitates management needs careful investigation. An inherent complexity here is that the management regimes vary in relation to the nature of the resource, such as water, forest etc. which cannot be generalized. The second is that it varies according to the community or the social system, including politics, rituals, knowledge, beliefs, etc.,and the evolved capacity in relation to the resource. The third is changes in peripheral pressure related to economics, politics, infrastructure etc.

MANAGEMENT

It could be argued that the nature of human interventions, particularly state interventions, have made a tremendous impact on CPR management for restoring or conserving without much emphasis on regulating the use. CPRs are part of the livelihood systems and valued by those who use it for multiple benefits directly for material output, and indirectly for service functions, aesthetic, religious and spiritual reasons. The collective enrolment has strengthened the social systems through sharing and cooperation while discarding individual rights to use and control.

Resource management issues in most circumstances are related to state policies on water bodies, reservation areas located beside paddy tracts known as “Wanatha”, the “Wewpity” the reservations of the irrigation tanks, remnants of village forests, open land and also some forests where local people have collectively been engaged in the management. The mutual respect for the community and membership, socially accepted regulations, practice of sharing, territorial occupation are some of the conditions that allow people to extend the feeling of community and rights of the community over resources.

Geographically the resources and the communities have well defined boundaries. The challenge here is that CPRs are held only on de facto grounds, without having legal rights to exercise a claim. No instruments and mechanisms endorse partnership between the legal owners, the state and the local custodians, the community. The state to a great extend fails to challenge the social conventions and traditional rules that have prevailed over generations in governing the common resources and the community interest in common property where the management of CPRs remain as inculcated features in the social system. Coordination, cooperation and conventions have enabled him to regulate the production and also solve disputes and conflicts. To what extent Information Technology (IT) can capture conventions and help process on-the-ground information is an important question.

TECHNOLOGY AND SOCIAL INSTITUTIONS

The gap between modern and conventional technology with regard to CPR management is huge. Technology at ground level where CPR regimes have evolved refers to indigenous management technology. Not only has such technology evolved in relation to community involvement, but also become a property of the community. The externality of modern IT, Remote Sensing (RS) and GIS has promoted a technocentric approach to CPR research and management. High cost involved in adopting/using IT has lead to a popular debate technology is for whom? and for what? The author under “Pixelising the Commons” and “Commonising the Pixel” has very artistically dealt these two aspects.

No doubt that GIS and RS have made a revolution in IT and have become powerful tools among researchers and planers. None of these techniques are simple or depict all the details that the researchers want. CPR Management addresses complex social, institutional, and practical issues. Some realities must be covered through anthropological, social, geographical, economic and ecological research, depending on the goals of research or the intervention. GIS and RS are used to generate and process information. The usefulness of IT in policy planning may be over emphasized without realizing the gravity of financial requirements, facilities and analytical skills. Within the area of CPR, IT is unable to capture essential information on community aspects including indigenous knowledge, social systems, community spirit and wisdom that are not reflected in colour, tone and texture. The information that one can generate using these technologies is technical. The cultural

nature of CPR management challenges the modern technology in this respect. While strengthening the technocentrism in CPR management, the centralization of CPR management mechanism, results in an alienation of the conventional technology on which CPRs have been managed over generations. Some of the achievements made through participatory research make it clear that the IT is not a way for more comprehensive, stimulating participatory research, but contributes to mapping CPRs with greater accuracy to design ground research, store and process information, analyse them and present them spatially to satisfy management requirements.

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Using Tools while Avoiding the Tool View

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In the context of the CPR management, technologies like RS/GIS/GPS may be useful for: a) building accuracy in the information on CPRs; b) improving the stakeholder capacity to handle information at large scales; and c) enabling users to negotiate the contested spatial boundaries through multiple perspectives. The other analytical tools like the Internet may be useful in providing access to information by users and helping the dissemination process if local language touch screen interfaces are available. In some cases, these tools may also help collaborative problem solving. However, most rural communities in developing countries do not have access to any of these technologies as yet. And yet their ability to manage CPRs must continually improve.

The sustainability of outcomes from the use of these technologies may depend upon several factors.

- As it was noted by Ostrom and other earlier researchers, CPR management at a community level needs to be understood within the policy framework that governs the CPRs. The capacity to handle information at a large scale can inform the policy making in a much better manner. Particularly important is the ability to assess the status and condition of the CPRs. However, as it was emphasized by Lele, despite the fact that the applications revolutionized our capacity to acquire information, these have not yet succeeded in making this knowledge accessible to local communities. In the process their capacity to question macro policies may not increase.
- Building accuracy in information and provision of indisputable and unbiased information through these applications may help conflict resolution in CPR management, whether it is through delineation of physical boundaries, or assessing the quantity of resource available. However, the collaboration among communities may sometime arise not because boundary is delineated precisely but because it is fuzzy.
- Remote Sensing in particular can provide the extent and sometimes the quality of resource over time. It is useful to monitor the degradation or improvement in the status of a resource periodically. Such information may also help in resolving conflicts and protect resources from threats like encroachments.
- Improving access and dissemination of information can contribute to or counteract the sustainability of the resource. Communication among users within a CPR regime across large distances may be facilitated by Internet-based networking tools. At the same time, easy access to information on availability of fish catches without consideration of the critical locations, such as spawning areas, through satellite technologies can lead to unsustainable outcomes through overexploitation. Such possibilities highlight the significance of locally evolved religious, spiritual, or cultural boundaries and regulations that are defined specifically to protect these critical locations.

The interface of the institutional dynamics with the process of technology generation has not been adequately addressed in the arguments so far. One needs to develop overlays of more than just the physical boundaries of resource use. One also needs to map social, cultural and political dimensions of access and use of resources, and other significant considerations that foster building sustainable resource management systems. As pointed out by Lele, certain indigenous tribes in places like Central and South America have been empowered by GIS/GPS technologies through participatory processes, but such has not been the case in other regions. At this juncture, the need to study the interrelationships among various resource endowments, cultural endowments, technologies and institutions becomes more obvious. A technological change should take care of the institutional dynamics of a resource system. While introducing a technology, it is important to find out the applicability and adaptations of the technology under local circumstances. Changes in institutions may also have implications for resource use, articulation of preferences, technological innovation etc.

In certain situations technological and institutional conditions complement or counteract the sustainability of natural resource. Many communities have witnessed dy-

namic interactions between technologies and institutions. Technologies of resource use can be non-sustainable and institutional conditions to counteract this have been developed by communities in ways that vary from case to case. Technologies may not also not be available to solve a given problem. In cases of technological constraint, institutional norms have evolved is some communities.

Linkages between institutions have helped solve problems. One good example comes from Belehra, a remote village in the Kangra district of Himachal Pradesh. There, a joint farming system has evolved where farmers pool one-tenth of their land holdings. The pooled land is cultivated collectively and the revenue out of this land is used for regeneration and maintenance of the forest land. Unless a farmer participates in the joint farming of the land, he is not allowed to claim his share in the grass from the regenerated forest land. Grass being an important resource for the livestock, a farmer cannot afford to lose his share. The institutional change was necessary to augment the opportunities offered by change in the policy context. However, the example is an interesting illustration of how linkages across institutions contribute to the overall sustainable resource management system/livelihood strategies.

The institutional context of technological change will invariably be quite crucial if the new analytical tools for study of CPR's have to succeed. Enabling users to negotiate the contested spatial boundaries through multiple perspectives implies, we help different stakeholders to articulate their cultural and socio-economic and spiritual aspirations and expectations about resource use patterns. It is the negotiation among these contested domains that would determine whether the CPR resources are used sustainably or not.

In addition, there are many limitations in the implementation of new tools for CPR management such as: (a) the neglect of interaction among technological and institutional aspects of NRM; (b) a low capacity for using such tools at the level of local government and village councils; (c) the possibility of a "tool view "of science overtaking the phenomenological perspective mapping only what is easy to map, i.e., the physical boundaries, while ignoring the contested but more central domains of varying consciousness among different stakeholders about the same resource.

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Harnessing Spatial IT for Conflict Resolution: A Potential Case of theTail Wagging the Dog

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My comment is restricted to common property land resources (CPLRs) where I foresee an immediate potential for harnessing spatial IT. CPLRs in India have been beleaguered by a number of problems leading to a) shrinkage and b) degradation. With the pressure of population and competing uses for land, both these problems have been increasing in intensity over time. These problems are applicable not just to designated CPLRs such as common pasture lands or gauchers, but also to open access revenue and forest lands which have strong potential for being managed as CPLRs.

In a recent field visit in different parts of dryland Karnataka, the author discovered that most of the CPLRs were either privatized or encroached upon. Similar evidence from other states indicates that the two main causes of shrinkage are a) legal privatization on account of misplaced priorities of state governments, and b) illegal privatization (encroachment).

Both forms of privatization have meant exclusion of the poor who were mainly dependent on such CPLRs for meeting their fodder, fuel and stress-food requirements. While encroachment is indulged in by both the rural elite and the poor, there is strong evidence to indicate that the extent of encroachment by the former is far greater. In fact, lack of action on the part of the bureaucracy is suspected to be the prime motivator for the poor to emulate the rich.

Recent cases show that encroachment by the rural elite had led to conflicts which remained latent for extended periods of time. The happened not just because of the skewed power equation prevailing in the village but also because of inaccessibility to land records: Pemaram Patel and Prakash Kashwan of Seva Mandir, Udaipur, who recently documented a case of encroachment of common grazing land at Viyal village, in Rajasthan, noted that:

"The villagers often have little knowledge about the exact legal status of the different types of land in their village. This situation is actually abetted by the panchayat and lower-level government officials, who purposely keep the villagers ignorant about the legal status of the land belonging to

the village. This enables the Patwari and other representatives of the people to dupe innocent villagers and earn money from illegal transfer of property rights."

Tenure-related conflicts also occurred where the forest department had created enclosures on forest lands to provide for the fodder and fuel needs of nearby villagers. Arun Jindal and D. Singh of the Society for Sustainable Development, Karauli, observed that in the case of Kailadevi Wild life Sanctuary, ambiguity regarding the forest, revenue and village boundaries have led to inter-village conflicts often leading to tearing down of the enclosures by the villagers.

GPS and GIS technology could help in resolving the type of conflicts described if placed in the hands of the poor. This was demonstrated for example in the case of the Zuni tribe of the USA where GPS was used to demarcate land boundaries which were under dispute, thus leading to resolution of internal conflicts and paving the way for revitalization of the indigenous farming system. Admittedly, the social pressures that prevents the poor from articulating their concerns in western India did not prevail among the Zuni. However, a few cases of successful eviction of encroachments have shown that participatory programmes such as watershed development and joint forest management, can provided the much needed opportunity and platform for the poor to address this issue. The process can be greatly facilitated if the poor have access to land records and maps. The challenge is to find an institutional mechanism to place GIS images of land records under public domain and make it accessible to the poor.

The issue of commonising the pixel should be viewed in the larger context of making accessible the fruits of new technology, if not the technology itself, to the poor. Both government agencies and NGOs can play an active role in this regard. In Dhar district of Madhya Pradesh, Gyandoot project of the state government which won the prestigious Stockholm Challenge Award for 2000, connects all villages through an intranet. Access to a wide range of services including land records is provided through cyber-kiosks run by local entrepreneurs. Karnataka Watershed Development Society, has made accessible RS/GIS images to grassroots NGOs implementing its watershed development programme in three watersheds of the state. The images provide valuable benchmark data on the state of the watersheds. Such initiatives will pave the way for commonising the pixel and in due course pixelising the commons.

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CPR FORUM RESPONSE

"Pixelising the Commons" and "Commonising the Pixel": Is GIS a Force or a Farce?

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The information technological revolution of the past two decades has greatly improved access to information - land use planning, census, geological and other biophysical data - through the use of GIS/Remote Sensing and Internet facilities. Although the costs of some of the data are high for researchers in developing countries, the new tools for 'pixelising the commons' are necessary evils if major inroads are to be made in understanding of the 'commons.'

While the task of keeping pace with new developments in the computer world as a whole may be daunting, the benefit has been a sharp reduction in the cost of computer systems and storage devices and a marked increase in processing power. GIS does not replace traditional tools but offers and extremely useful complement to them. This has created opportunities for geographers, and other social scientists, to apply their essentially traditional skills to a whole new array of information sources.

The new analytical tools give researchers the ability to examine the variations in earth processes over time using digital data on local, regional, and global scales. Recent technological improvements such as the Internet have meant access to millions of satellite images, vector maps, demographic files and other GIS-compatible data, allowing a better understanding of terrestrial processes and better management of human activities.

Over the years, a number of social, political, and ethical concerns have been raised with regard to its use of some of these analytical tools. There are bound to be problems but these can be addressed as the system is perfected. Some of the concerns about these new analytic tools are outlined below:

- Software suppliers drive the applications of GIS and this results in a mismatch between in the information management ideology of the suppliers and that of the receiving organisation.
- The 'technology-led' focus of GIS suits the purveyors of hardware and software and may lead to misuse of information technology systems and such inappropriate uses may lead to project failure.
- In relation to data issues in developing countries, the concern has been that although remote sensing

offers a great deal for environmental and land-cover mapping, gathering the needed socio-economic data often requires expensive field surveys and raises issues of ethics and power. Such data are often both scarce and of questionable quality. There is a lack of spatially referenced data sets and the cost of converting data into a digital format is often high. Even where data exist and can be converted into digital form, there may be inconsistencies in geo-referencing systems or scales, and difficulties in sharing of data and the coordination of information flows between users.

- Again, where resources are restricted, people are often forced to make decisions about whether they can justifiably utilise poor-quality data systems in systems which assume accurate data sets and high degrees of spatial resolution. The answer depends on the objectives of the project.

Despite some of these concerns, the GIS/Remote Sensing revolution has improved the decision-making environment of the "commons." Its advantages far outweigh its disadvantages and this has led to increasing popularity. It is becoming an important tool for development planning. Its applications include suitable habitat selection, map making, emergency response planning, and simulating environmental effects.

Lele's paper makes reference to an important study carried out in India where GIS was "successfully" used to map the environmental resources of every plot of land and create a database to support sustainable development. A team was trained to construct basic data, including the location of boundaries, transport and communications facilities, services such as schools, clinics, temples and shops, economic resources such as industries and natural resources such as water bodies, forest and wastelands. A technical team mapped the local geology, geomorphology, land use, and such foci of environmental concern as areas subject to flooding, landslides, soil erosion and other forms of degradation. The results were then merged in a GIS. The output of this exercise was among other things, a detailed map of the study area's resources and some suggestions for interventions in the short, medium and long-term action plans in consultation with the people.

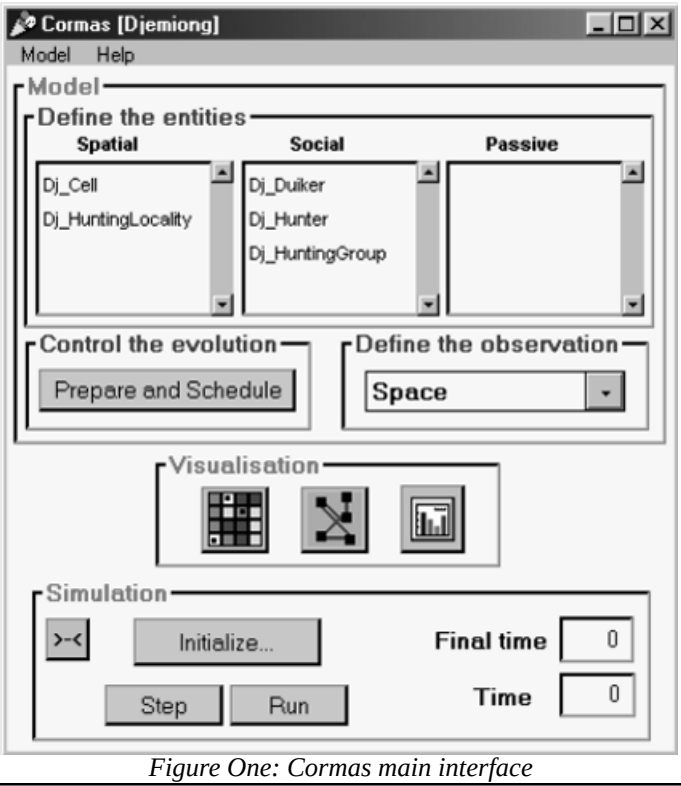

Figure One: Cormas main interface

GIS also has applications that are relevant to the analysis of land use patterns for management of watersheds falling in Africa's watersheds. The ability of GIS to store attribute data in a seamless database and perform mathematical, statistical and other forms of data manipulation enables for applications that combine the attributes of different layers of data for a specific application. Mugabe successfully used GIS to map and make predictions on expansion of cropland in dry land agriculture on the basis of combined weights of land factors including soil fertility, slope, and soil moisture factors. This produced a useful tool in landscape management and planning that is applicable at a very small scale.

These examples amply demonstrate what a force GIS has become in developing countries planning sustainable development programmes. Thus, to use Lele's terms, the above discussion demonstrates that pixelizing the commons is a boon.

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CPR FORUM RESPONSE

Combining MAS with GIS: Another Way to "Pixelise" the Commons?

Olivier Petit

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One of the questions raised by Dr Lele''s Commentary concerns the capacity of GIS to increase the comprehensiveness of researchers, planners and resource users. I would like to go further in this direction and focus on the possibilities of improving stakeholders' participation and understanding concerning CPR issues by combining two types of largely complementary computer applications : Multi-Agent Systems (MAS) and Geographical Information Systems (GIS).

I want to develop an argument that another way to "pixelise" CPRs is to use MAS as a means to model interactions between natural resources and resource users. MAS can gain from being coupled with GIS technology, as many experiences already show.

MAS, which originated from Artificial Intelligence (AI), belongs to the emerging science of complexity. It is aimed at simulating a wide range of phenomena, especially when "classical" modelling is confronted with difficulties in accounting for irreversibility and the uncertainty effects of dynamic interactions between entities. The field of natural resources and environmental management is characterised by interactions between economic, ecological and social dynamics. MAS can help by: drawing a representation of the systems dynamics; taking into account different "points of view" on the resource use and different governance rules; and resolving resource management issues by clarifying the key questions and by shifting from "learning by doing" to "learning by simulating."

Moreover, coupling GIS with MAS allows the integration of social behavior with spatially defined natural resources. The cell, the basic spatial unit of MAS, can contain geographical data; while social, economic and even symbolic data, stored by the computer, are integrated within the properties of agents, passive entities, or social entities. Applied to CPR, MAS also enables the integration of a multi-level perspective and takes into account the interactions occurring between economic, social and ecological entities.

Among existing multi-agent simulation platforms, CORMAS (Common-Pool Resources and Multi-Agent Systems http://cormas.cirad.fr/indexeng.htm), a generic simulation platform based on Smalltalk, is particularly well designed to address problems of CPR governance. CORMAS was first developed by a team at the Centre de coopération internationale en recherche agronomique pour le développement (http://www.cirad.fr) and is used by people in many countries and from various disciplines such as ecology, economics, sociology, agronomy, hydrology, etc. Implementing the principles of CPR to software development, CORMAS is freely distributed and constantly improved through the experience of users and developers, thus forming the CORMAS community. Since the beginning of the platform development, the basic idea was to integrate the spatial entities as the core of the modelling process (http://cormas.cirad.fr/en/applica/applica.htm). Social and passive entities interact with spatial ones which constitute the medium of most interactions. An interesting example of application is the Djemiong model developed with CORMAS and using GIS files to model and to simulate the hunting of a small antelope, called "the blue duiker", in a village located in eastern Cameroon. Djemiong helps us understand the coordination issues among hunters in the village.

The model is based on a representation of the site using GIS data. Hunters are represented by different rules of comportment and capture based on trap locations. Interactions between hunters and their prey (and between animals) are simulated : the cells' properties and the agents characteristics are modified all along the simulation. CORMAS offers the possibility to visualize the mapping of different points of view on the resources and agents of the system. The above presented figure shows in the same map the rivers, the roads and a configuration of trap location. In each cell, an icon represents the population of "blue duiker" (alone, male, female or with a partner). A few others points of view are available but not presented. Finally, this model shows how different scenarios and rules for trap location can influence the (un)sustainability of the resource.

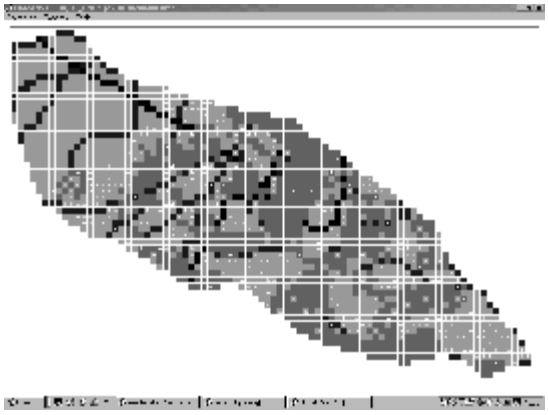

Figure Two: The Djemiong artificial landscape in Cormas.

One of the major advantages of this approach is the ability to open up the relations between scientists and local users. For instance, it is possible for local people to be implied within the process of modelling (building, structuring), to define the parameters and to experiment simulations.

This kind of approach enables to directly take into account the users'concerns, to commonly define the properties of the resource, and experiment several kinds of management practices according to the different feelings. In conclusion, this type of modelling can help to resolve conflicts and constitutes a decision support system.

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Further reading: Bousquet, F., R. Lifran, M. Tidball, S. Thoyer et M. Antona (2001), "Agent-based modelling, game theory and natural resource management issues", Journal of Artificial Societies and Social Simulation, Vol. 4, Special Issue, n°2.

PRACTITIONER'S PROFILE

The Society for Research and Initiatives for Sustainable Technologies and Institutions

Anil Gupta

What does your program do?

SRISTI is a voluntary organization that supports the Honey Bee Network a world-wide network of innovators and traditional knowledge experts involving the entire value chain from locating and disseminating traditional knowledge to building bridges with formal science. It rewards the creative spirit through material and non material incentives aimed at individuals and groups. SRISTI has developed a database of 84 indigenous CPR institutions from 24 countries which is shared without any cost with anyone who is willing to share it with local communities. Just as the Honey Bee does not deprive flowers when it collects pollen, local people should not be deprived when we document their knowledge and get rewarded for it. The Honey Bee data base has collected more than 12000 innovations and traditional knowledge examples in primarily rural but also urban areas. SRISTI also has a natural product laboratory to pool best practices of local experts in the field of herbal pesticides, veterinary medicine and microbial diversity as indicators of soil ecosystems health. The Honey Bee network is perhaps world's largest database on grassroots knowledge, innovations and creative practices. See a sample of a knowledge network being developed in several Indian languages at www.sristi.org/knownetgrin.html.

How did you get started?

Honey Bee network started twelve years ago when several students and colleagues shared the guilt of not being accountable enough towards local knowledge providers and felt that an ethical, and responsive system had to be evolved. *The metaphor of Honey Bee came to our mind and as they say, after that there was light in our lives***.**

How is your group funded?

Primarily through contributions from individuals and communities. In addition, International Development Research Centre of Canada has provided the most comprehensive support in a very collegial manner. The Swiss Development Cooperation provided support in late eighties. Later several other agencies including UNDP-GEF have supported various parts of our activities. The Infodev initiative at the World Bank has invested in setting up local IT kiosks for networking innovators, a web based clearing house among innovators, investors and entrepreneurs, and in expanding a multi-language multimedia innovation database.

What have been your most important accomplishments?

The recent Indian Government draft policy for Science and Technology recognizes the role that grassroots innovations play in achieving self reliance and overcoming poverty. The National Innovation Foundation was set up by the Department of Science and Technology last year to scale up the Honey Bee network and achieve goals that SRISTI has been pursuing on a small scale. This effort is creating a register of green technological innovators and helping them develop their innovations. Another effort, the Grassroots Innovation Augmentation Network- Gujarat, is the first Indian micro-venture promotion fund through which several innovations have been licensed and the benefits have gone entirely to the innovators. SRISTI's Honey Bee database has triggered similar initiatives in countries such as Paraguay, Thailand, Philippines, Columbia etc.

We wrote the first obituary of the term, 'Resource Poor Farmers' so popular with WTO, World Bank, academics and planners world wide. We argued that this phrase means either knowledge is not a resource or that people have little knowledge. In 2000, the Far Eastern Review chose our work for an Asian Innovation Award. The Business Week Asian edition call us a Star of Asia this year. We have been featured by the BBC and The Economist and the International Herald Tribune and New York Times Magazine are also reporting soon on our work.

What lessons have you learned that would be useful for other groups involved in CPR management?

In the absence of a properly calibrated portfolio of incentives which recognize, respect and reward production, reproduction and dissemination of knowledge the creative impulse at the local level will not be unleashed. We should go beyond 'Crafting' of institutions and instead start thinking only about 'Grafting' of institutions) where necessary through blend of modern science and technology, institutions, and cultural values. We assume that there is never an institutional vacuum in a living vibrant society. The local innovations can be a very viable building block for rethinking the whole developmental paradigm. Yet, so little documentation of and value addition in local innovations is available outside of the Honey Bee network. We have also learned that women, in areas in which they have control over choices, have unbounded creativity. Documentation of innovations by women requires new strategies and this has been a weakness of the HB network.

What would you like to learn from or about the experience of other CPR groups?

Examples where policies, institutions, pedagogies evolved by people on their own have been allowed to expand space for the expression of creativity and innovations of people.

How can readers get in touch with you?

They can subscribe to the Honey Bee newsletter and support the movement

SRISTI, Phone /Fax : 91 79 6307341 phone 91 79 6404292, 404293 Post Box, 15050, Ahmedabad 380015

email: Anilg@sristi.org, Sristi@vsnl.com, Sristi@sristi.org

www.sristi.org www.nifindia.org www.gian.org

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Laura Wisen

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The International Association for the Study of Common Property

The 9th Biennial Conference of the IASCP

17 – 21 June 2002 in Victoria Falls, Zimbabwe.

Call for Papers

Practitioners, academics, scholars and anyone interested in the study of common property issues and globalisation are invited to participate in the conference. IASCP encourages interested people to submit panel, individual paper and poster abstracts not exceeding 500 words by October 1st 2001to the Secretariat at the following e-mail address; iascp@cass.org.zw. Final papers should be submitted by April 1st 2002 in Microsoft Word or Word Perfect

Conference Theme: 'The Commons in an Age of Globalisation'

Globalisation is a pervasive characteristic of the new millennium and highly topical in terms of the attention now being given it in the social and ecological sciences. It is seen as the latest stage of a process where technological, economic, ecological, cultural and military trends, traditionally observable on a geographically limited scale and scope, are extended to the entire globe, leading to the emergence of new players with new and different (power) relationships among them. For the 'developing world', the asymmetrical power dimensions of these relationships are of particular relevance, not only in terms of the cultural and conceptual hegemony associated with globalisation.

The conference theme should be addressed from a broader perspective, not restricted to natural resources management, but to include issues of governance, economic systems and hidden values, tourism and global ideology. The central concepts of cultural diversity, marginalisation, and globalisation deserve attention in this global debate. There are issues of diversity and uniformity, scale issues and nested hierarchies that globalisation as a concept implies which ought to be addressed. Under globalisation, whose interest does the state serve and what are the related implications on traditional resource and intellectual property rights? A major challenge is the use of practical cases that offer practical solutions to the global debate on globalisation and the commons.

Sub-themes

1. Globalisation, Governance and the Commons

Structure, organisation and relationships would be foci for this sub-theme. How do governance perspectives, e.g. Regime Theory and Global Governance, affect Common Property Theory? The nature of governance, the centre-periphery relations, both at sub-national and supra-national levels and the shifting role of the nation state and issues related to Common Property under globalisation should receive attention. The match/mismatch of jurisdictional, ecological and functional scales should be examined.

2. Globalisation, Culture and the Commons

Culture has been a relatively unexplored factor in common property scholarship. As such, globalisation provides a rich palette on which to examine the relationship between culture and commons management and use. What role does a deep understanding of culture and globalisation play in common property management and use? Concepts of stewardship, inter-generation equity and sustainability, cultural homogenisation will be examined.

3. "Protected Areas" in Constituting the Commons

The "Protected Area" (PA) approach has been one of the two "mainstream" strategies for conservation (the other being species conservation). For urban and industrialised societies it remains a principal mode of the use of nature, and is held out as a paradigm for the developing world. In Africa, its impact on land use and state appropriations of nature has been profound. PA advocates have begun to reach out to more people-centred approaches but this initiative has had little impact from social scientists and an ecological perspective. Papers in this sub-theme are expected to link up local-level issues with globalisation and explore the linkages of Pas and development programs in comparison to people. There is need to rethink protected areas in the age of globalisation by going beyond wildlife resources.

4. Land/Water and Resource Tenure and the Commons in an Era of Globalisation.

Land/water tenure has long been an important issue for common property scholarship because common property regimes are always imbedded within wider sets of property relations. Globalisation has introduced new pressures into national and local contexts. What form does land/water reform and resource tenure take under globalisation and what impact does this have on CPRs? Examine how globalisation impacts on existing forms of tenure and the form of integration between customary law, traditional authority, gender and statutory law. In what ways do all these encompassing regimes of access and entitlement to resources help to define the character of specific arrangements for the use of common property resources? Pay particular attention to promotion of equality in access to resources for all citizens, decentralisation/devolution of resource management and increasing stakeholder involvement in resource management. What is the effect of such measures in facilitating the improvement of livelihoods of rural poor and to what extent are equity issues addressed?

5. New Analytic Tools for CPR Management

The past two decades have witnessed technological improvements and the increased use of computer applications (GIS, Remote Sensing, internet and satellite imaging) designed to support the capture, management, manipulation, and analysis of spatially referenced data for solving resource management problems, among others. What role does technology play and what factors inhibit the use and application of these new analytic tools for Common Property Resource management and use? Issues of cost and access to technology, data sharing and standardisation, and ethical considerations are key.

6.Indigenous Knowledge Systems, Integrity of Commons and Emerging Regimes of Intellectual Property Rights in a Globalising World.

The meaning of indigenous remains contested, but however it has implications on issues to do with time, place-specific and personal experiences of particular people within given cultural settings. Case material should highlight social differentiations in common pool resource management, the role of indigenous knowledge systems and their contribution to the future integrity of the commons (e.g. the Aborigines as a distinct ethnic group). How does the social organisation of knowledge systems, indigenous knowledge systems and intellectual property rights impact on the sustainable use and management of the commons? International conventions, bio-piracy issues, the role of diverse knowledge systems and prospects for sustainable natural resource management ought to be discussed.

7.Trans-boundary natural resource management and the commons

Co-operation across boundaries that enhance the management of natural resources for the benefit of all stakeholders (TBNRM) has of late come into the limelight because of increased competition over natural resources by users of various levels; community, national, regional and international. What form should policy making, legislation, laws and governance between national boundaries under globalisation take for effective co-management of CPRs? The TBNRM perspective calls for the creation of common policies, legislation, laws and governance that are in harmony.

Detailed information on the theme and sub-themes can be accessed on the IASCP website; http://www.indiana.edu/~iascp/2002.html , while hard copies of the same can be requested from:

The Secretariat, IASCP/ CASS
5 Aberdeen Road, P.O Box A1333,
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CORE AND VISITING FACULTY POSITIONS IN ENVIRONMENT-DEVELOPMENT STUDIES

The ISEC-ATREE Centre for Interdisciplinary Studies in Environment and Development (CISED) seeks to recruit highly motivated and dynamic scholars as **Core** and **Visiting Faculty**.

Qualifications: *Candidates for **core faculty** positions* would typically have a Ph.D., and a strong track record of academically rigorous but socially relevant research on issues that lie at the environment-development interface. They could be rooted in **any branch** of either the **natural/physical/engineering sciences** or the **social sciences**, or have a highly interdisciplinary background. *Candidates for **visiting faculty** positions* could also be persons with a more activist or policy-making background who wish spend some time away from their ongoing activities to reflect, write, debate and advise on issues in an academic setting.

***Focal areas*:** Scholars who have worked on **any aspect** of the **environment-development interface** in a developing country context are encouraged to apply. Preference may be given to candidates working in the fields of urban and industrial **pollution**, **energy**, **climate change**, or **agriculture**. Scholars whose work **cuts across** sectoral lines are also encouraged to apply. **Deadline for applications is November 15, 2001.**

For further information, contact: Dr. Sharachchandra Lele, Coordinator, CISED ISEC Campus, Nagarabhavi Bangalore – 560 072 INDIA
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Commons Listserve

The IASCP maintans a simple list serve email facility for passing on announcements. This is a way to send a message to many people at one time through a single email address that the people have signed up for. Users can subscribe (or unsubscribe) by sending a message to **mailserv@aesop.rutgers.edu**. In the body of the message they should type: *subscribe commons*. Those wishing to send announcemens to the subscribers should send the message to **commons@aesop.rutgers.edu**. Be sure and avoid sending subscribe and unsubcribe messages to the whole list by sending them to commons@aesop instead of mailserve@aesop.

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