VERIFOR
Options for forest verification

Briefing Paper

February 2007

7. New technologies in support of improved forest governance: factors influencing success

Neil Bird and Hans Thiel

Summary

This paper examines how new technologies are being introduced as a means to strengthen national forest governance systems, taking the example of Brazil where their uptake is advancing rapidly. Some key elements to consider when contemplating the introduction of new technologies are described. These include: the management required to oversee the transition between the old regulatory system and the new, technology-supported system; the institutional reforms triggered by this technological change; and the impacts of the new technologies in terms of changes in the detection of forest crime, the level of illegality and tolerance of corruption. The safeguards and mechanisms of public oversight that have been introduced with these changes are also examined.

POLICY CONCLUSIONS

- Technological advance by itself will not bring about improved forest sector governance. The key is to ensure broad appreciation of the improvements made possible by the introduction of new technologies and the uptake of these technologies in the strategies and plans of the forest sector.
- A legal framework is needed that recognises the use of new technologies for law enforcement and allows for the conduct of public administration procedures on-line. Neither of these provisions may exist in present legislation. It is therefore important that any strategy to introduce technologies within the state regulatory system pays attention to early legal reform.
- Where the forest administration remains an 'island of modernity' within a broader public administration that still uses traditional paper-based procedures, any gain of e-government in the forest sector will remain limited. The introduction of forest control technologies must therefore be integrated with similar technologies throughout the wider government structure (e.g. land tenure, judiciary, tax and revenue).
- The potential of the internet to make information about timber harvesting control and verification available in a clear and transparent way offers a significant increment to the quality of governance. It increases the credibility and societal support for agencies in charge of forest law enforcement.
- Integrated database technologies have the potential to enhance decentralized forest governance systems, provided that the concurrent exercise of authority of each tier of government is clearly defined.
- The myth that rural communities are reluctant to use modern technologies and the internet has already been broken, as is evident by their enthusiastic use of mobile phones and SMS-messages. The introduction of new technologies in the forest sector needs to build on this potential.

Computerised administration of logging controls improves bureaucratic efficiency

odi Overseas Development Institute

RECOFTC

CIFOR

CATIE Tropical Agricultural Research and Higher Education Center

VERIFOR is an applied research project co-funded by the EC's Tropical Forestry Budget Line and the Governments of the Netherlands and Germany. It will provide practical, research-based policy advice for decision-makers on the verification of legality in the forest sector. The coverage is pan-tropical. http://www.verifor.org/

Introduction

The application of innovative technology opens up new possibilities for regulatory control in the forest sector. The introduction of such technologies is gradually taking place as countries recognise the potential benefits and develop the necessary capacity. Brazil is one country where there has been considerable investment in technology to help address the challenges of effecting control over a widely-dispersed sector (Thiel and Viergever, 2006). This paper examines these new technologies from a governance perspective and suggests how they can be supported by institutional arrangements that strengthen public accountability and transparency, and allows for independent action. This first section provides a general overview of these new technologies in the context of the forest sector; Part two considers the case of Brazil; and Part three draws the findings together and identifies some key issues that influence the successful uptake of new technologies in forest governance systems.

What is a forest governance system?

The term 'forest governance system' refers to the policy and legal framework that defines the nature and scope of rights held by different stakeholders, together with the institutional roles and responsibilities defined in the legal framework (Box 1). It includes the regulatory function of government to carry out law enforcement, and also encompasses the checks and balances necessary to establish public accountability.

Box 1. Forest Governance System: a definition

A Forest Governance System (FGS) consists of the coherent interaction of the policy, legal and institutional elements that ensure equitable forest law enforcement and improved sectoral governance. An important element of a FGS is the verification of the laws governing forestry to ensure that they are observed by all those involved in timber harvesting and trade. But verification does not stand alone: its robustness depends on strong trans-sectoral political backing by national decision makers and the leadership of visionary individuals, and also on processes oriented to optimize the normative environment to make it more coherent, simple and enforceable. With respect to the institutional architecture, we now understand the importance of clearly defined roles for national and decentralised actors and of systems in which all parties involved interact, generating cross-checks and balances, social accountability and transparency.

What technologies are involved?

A major innovation in recent years has been the introduction of remotely sensed data taken from satellites and high altitude aircraft to produce images of forested landscapes. This has complemented aerial photography that has been available for many years, as it allows for images of much larger areas. As the information is in digital form, it can be transformed and incorporated into geographical information systems and combined with other types of geographical information (e.g. topographic maps) to build up a comprehensive analysis of forest cover and, over a period of time, land-use change (of which deforestation is clearly a major interest). Other information can be added through the use of global positioning systems that identify the location of point data. Relevant data for the forest sector can range from the location of wood processing facilities to the position of log collection points in the forest to individual trees. Internet-based technologies (including on-line and integrated databases that are accessible to users over the telecommunication system) offer new opportunities to communicate information that previously relied on paper-based transactions. Administrative forms and authorisation permits that form the core of all national forest regulatory systems can now be transferred electronically between the forest authority and its clients, offering huge savings in time and administrative procedures. More broadly, the world-wide-web is an exceptional tool for making forest administration information available to society in a transparent way.

What is expected from these new technologies in forest governance systems?

There are a number of governance failings in the forest sector that these new technologies need to address. A common problem is poor accountability caused by a lack of information, with knowledge on forest licenses and revenue payments often not open to public scrutiny. This can lead to corruption within the regulatory authority, due to a lack of transparency in the system. More generally, insufficient coordination and connection between government information and administration systems leads to considerable inefficiency. This is a problem that goes well beyond the forest sector and commonly includes land tenure records, environmental administrative procedures, land-use change monitoring, and public tax and revenue collection. Where forest administration offices are located in regional centres, remote from forest areas, affordable access to regulatory services by rural businesses is often low.

If large-scale uptake of new technology in the forest sector is to occur then different groups need to see that significant gains will come about as a result of using this technology and these will address some of the problems mentioned above. From the perspective of the state, three major benefits can be identified. First, is the expectation of greater transparency and reduced opportunities for corruption. Through the automation of input and output standard forms and permits, there is less scope for the forgery of such paperwork. Second, there is a greater chance for the timely publication of statistical information including geographical data, licensing and sanctioning processes and outcomes. This will increase the overall transparency of the regulatory system. Third, technologies offer the possibility of improved public sector management. This can be achieved in several ways, for example by:

- the simplification of bureaucratic tasks;
- improved public revenue collection;
- the optimal allocation of limited law enforcing resources to strategic enforcement;
- an easier identification of bottlenecks in the administrative system which can act as points for delay and possible corruption; and
- improved communication between different parts of the

government administration that allows for the timely supply of information for policy decision making.

Forest operators can also expect direct gains through improvements in the private sector investment climate. This will come about by more transparent and competitive concession allocation procedures and timber sales, and the provision of the tools for an electronic market place. The latter aspect is weakly developed in many tropical timber-producing countries but offers the possibility of a much faster and more efficient system of sale compared to traditional marketing methods. The use of new technologies should also lead to more convenient and affordable services for all forest stakeholders through streamlined service delivery.

What factors prevent these technologies from contributing to enhanced forest governance?

The introduction of new technologies is not driven solely by technological considerations. Other factors need to be considered when evaluating the potential role that technology can play within a regulatory system.

Political factors can act as a major constraint, especially when the forest sector is given low political priority. Interest groups that benefit from the status quo are likely to oppose improvements in the regulatory system if they will lose out as a result. Thus, strong leadership, either from within the public administration, industry or civil society, may be required to lobby politicians to support change. The introduction of new technological systems may also be undermined where there is a lack of government policy and strategies for their introduction and management more generally in the government service. In addition, public inertia can act as a constraint. Where the citizenry has limited opportunities for participation in decision making, they are less likely to embrace technological advances which might improve its quality. Such attitudes can be entrenched by a general lack of trust in the ability of public institutions to carry out their statutory functions.

Legal factors also need to be considered. A legal framework that does not recognise electronic identities for administrative purposes or remotely-sensed data for law enforcement will require revision prior to the full introduction of new regulatory controls. This may slow down the introduction of technology in the field of monitoring legal compliance.

Institutional factors can act as significant constraints on the uptake of new technologies. A limited public budget and infrastructure devoted to forest administration and consequent lack of trained staff to keep up with technological change are common problems. The opportunity to benefit from specialisation may be missed through the concentration of diverse responsibilities in one institution (often the case with national forest authorities). Lack of coordination between institutions over the introduction and development of such technologies and overlapping and/or conflicting roles and competencies between different levels of government are further constraints that need to be addressed.

Finally, technological constraints need to be overcome. Access to the internet remains unreliable or non-existent in many rural areas. Although computer hardware has improved hugely, reliability is a problem where dust and humidity are high. Efforts to increase the uptake of technology in forest administration are hampered by a lack of specialised software and remotely sensed data. For example, the use of visible band imagery is constrained in the humid tropics, as cloud cover severely limits the number of days when data can be collected. Even when data sets are available, matching images to field observations may prove difficult where global positioning systems lack accuracy, constraining their application in law enforcement activities.

How these constraints can be overcome: the case of Brazil

These constraints are now being addressed. A particularly instructive example is Brazil, which has made significant investments in new technology as a response to concern over deforestation in the Amazon.

Clarifying roles and competencies between different levels of government

In October 2006, Brazil's National Environmental Council (CONAMA) issued Resolutions 378 and 379, giving the states within the federation one year to assume forest competencies within the framework of the National System of Environmental Management (SISNAMA) (MMA, 2005a and 2005b). All states will have to put in place their own forest administration and control systems by that date. These will have to be linked into both the National Forest Information System (SISCOM) and the National Information System of the Environment (SISNIMA).

A protocol for sharing roles and responsibilities in a new decentralized forest regime is under discussion by the Inter-institutional Commission to Coordinate the National Forest Programme (CONAFLOR)[1]. This is an important step forward. Prior to these resolutions, the federal agency for the environment (IBAMA) had overlapping competencies with the intermediate level of the states, leading to inefficiency, duplication and even serious conflict. Unclear roles and competencies between levels of government made it impossible to establish a coherent land licensing and forest administration system, and prevented the uptake of new technology.

Although the states have the freedom to implement their own control systems, they can also request cooperation from IBAMA. The terms of such cooperation are set by the federal authority and include an agreement to introduce electronic systems and a multi-stakeholder commission to monitor their introduction. The federal-level institutions, IBAMA and the Ministry of the Environment (MMA), have made a newly developed electronic forest control system available to the states without cost, and also provide training in its introduction (see DOF, below). Monitoring of illegal forest activities nationwide will still be carried out by the MMA, IBAMA, the Federal Prosecutor (Ministerio Público) and the Federal Police, which are all part of the Inter-ministerial Working Group to Combat Deforestation in the Amazon (GTPDA). The presidential Decree by which the GTPDA was established has ensured the involvement of ten ministries. Enforcement, regulatory and technological providing bodies, such as the National

1. *Processo de Descentralizacao da Gestao Florestal, Documento de Discussao, Versao 1.3-30.03.06*

Box 2: The state of Mato Grosso: technological progress supporting sector reform

In 1999, the State Environmental Foundation of Mato Grosso (FEMA: Fundación Estadual de Meio Ambiente), with the support of the PPG7, developed the Land Zone Planning System SLAPR (Sistema de Licenciamiento Ambiental em Propriedade Rural). This pioneering information system aims to reduce illegal deforestation by combining environmental licensing of rural properties with monitoring and control of land-use change in a centralised database. The system applies to private forests, containing information on the geo-referenced boundaries of each licensed property, the 'legal reserve' area within the property that must retain forest cover and all 'protection areas', including steep slopes and buffer zones alongside watercourses. These data are entered into the system once an environmental licence is issued for a given property. Forest cover change can then be monitored from satellite images and, if necessary, enforcement activities can be initiated.

Initially this system proved to be slow in making any noticeable impact on law enforcement. Data from 2004 showed that illegal deforestation in licensed areas had not been significantly reduced, when compared with unlicensed areas. This indicated continuing weak enforcement and sanctioning of illegal deforestation. An evaluation of the SLARP system of Mato Grosso commissioned by the MMA and the PPG7 found that (MMA, 2005c):

- There were overlapping competencies and a lack of information flow between FEMA, which issued deforestation permits for licensed properties in SLAPR, and the federal agency IBAMA, which was still in charge of giving out timber harvesting licences and timber transport permits.
- There was conflicting legislation at state and federal level.
- Land tenure issues were not articulated between the state and the federal level, leading to overlapping of property polygons.
- Information regarding law infringement was kept within FEMA and not shared between enforcement agencies and the public.
- Long lasting administrative procedures, often resulting in soft sanctions, left the impression of impunity.
- Insufficient sharing of information and satellite images to all actors increased suspicions of fraudulent 'image make-up'.

These flaws became apparent in two spectacular anti-corruption operations in June and August 2005. Operação Curupira 1 and 2 were carried out as coordinated actions between the Ministry of Environment, the Ministério Público and the Federal Police and found that certain officials at FEMA had favoured those carrying out illegal deforestation. They had manipulated satellite images in favour of offenders and produced fake documentation to launder illegally obtained timber. Shortly after the coordinated enforcement action of Operação Curupirá, FEMA (which had been a semi-autonomous foundation) was suspended and subsequently replaced by a state institution within the public administration, called SEMA (Secretaria de Estado de Meio Ambiente de Mato Grosso). SEMA immediately signed an 'agreement of technical cooperation' with the federal agency IBAMA and the MMA. This aimed to clarify roles, competencies and jurisdictions for decentralised forest administration and control. The agreement also increased transparency by clarifying information and data flows, and concurrent monitoring and enforcement activities by IBAMA. When in March 2006 the new Law on Public Forests transferred the responsibility for licensing and monitoring of forest-related activities to states, SEMA took statutory responsibility for all these competencies. However, because of the concurrent responsibilities, IBAMA retained an oversight and control function ('acoes supletiva'). Importantly, SEMA added two new technologies to the SLAPR system to administer these competences in Mato Grosso: a database of forest product producers and consumers (CC-SEMA) and an on-line forest products administration and control system (SISFLORA).

To harvest timber or clear natural forest in Mato Grosso, an environmental license (LAU) must be obtained as part of the SLARP system. Additionally, a forest management plan or a deforestation permit must be approved by SEMA, which then generates a timber volume 'credit' in the SISFLORA system. Timber producers registered in the CC-SEMA database can manage the timber volume 'credit' online and print out their timber transport permits. To be registered in CC-SEMA, users have to prove their legal status and compliance with relevant regulations and taxes (as regards tenure, taxes, environmental licences and municipal approval, etc.). This is done to ensure that the whole production chain is covered by the control system and to prevent fake companies being used to launder illegal timber (as has happened in the past). Once registered in CC-SEMA, forest operators can access the SISFLORA system online by entering a personal password. Producers can access the timber volumes and offer these volumes online to registered consumers from the industry. Timber volumes are automatically debited from the volume credit (by species) of the management plan only when the consumer accepts the offered timber, and the transaction has been entered into the system. A bar-code-individualized timber transport permit (GF) is then printed out. An interesting innovation of this system is the link established between producers and consumers in an administrative process. This offers the potential for an electronic exchange (market) for legally produced timber between actors that are registered in the CC-SEMA.

Registration with CC-SEMA has been problematic. Users have to submit legally authenticated papers and certificates, which has proven to be a heavy bureaucratic burden, even for the bigger, more formal operators in the timber industry. The disincentive effect has been much greater for smaller and less formal operators. SEMA's requirement for authenticated documents, even for its own administrative procedures, shows that modern information networks do not yet fully exist for communications within the public administration. Another imperfection is that each timber transport permit must be physically signed by the consumer. This has been identified as a hindrance by users and is inconsistent with the design of the SISFLORA system, which assumes electronic and not physical signature-based authentication of the operators.

Institute for Space Research, INPE, are also involved, to combat deforestation in an integrated manner. The provision of technical data sets (e.g. remote sensing) has been a critical factor in developing an overview of the situation throughout the Amazon. Considerable reliance is now placed on the DETER System. DETER[2] is a satellite-based monitoring system able to detect illegal deforestation in the whole Amazon Region in 'near real-time'.

Strengthening the competency of public forest authorities

Since 2003 IBAMA has engaged a significant number of new employees, adding more than a quarter to its staff numbers. This has happened in parallel with enforcement activities that removed dozens of staff indicted due to corrupt practices. This now seems to be creating a critical mass of young, proactive professionals confident in the use of new technologies within IBAMA. A similar process is underway at the state level, since the decentralisation process of forest competencies to the states does not include the transfer of resources from IBAMA. Additional capacity within state environmental agencies is therefore being created, providing an opportunity that new technologies may find a better institutional foundation than was the case previously.

Creating new information systems

Resolution 379 of the National Environmental Council (CONAMA) created the System of Data and Information about Forest Management. This requires all state environmental agencies to set up forest information systems. Basic standards and minimum criteria to be adopted by these state information systems are defined at the federal level. The state systems must allow open access in order to feed information into the National Forest Information System, SISCOM. According to normative instruction No. 5 (MMA IN No. 5 / 11.XII.2006) all approved forest management plans will have to be registered in the National Cadastre of Sustainable Forest Management Plans (CNPM), which will be open for public access over the internet. This information will be up-dated in a centralised database at least twice a year and an annual report by each level of government provided to the federal forest service. This amount of information management would simply not have been possible prior to the introduction of electronic databases. Some of the early information systems were pioneered at the state level, particularly in the state of Mato Grosso (Box 2).

Technological progress at the federal level

A new electronic forest administration and control system has been under construction for several years by IBAMA. This is the 'DOF System' (Documento de Origen Florestal.) DOF was introduced nationwide in September 2006. In order to comply with this new control system, forest operators must register within an administrative database, the CTF (Cadastro Técnico Federal). CTF has been in place since 2001 and is also accessible on-line. In contrast with the CC-SEMA database of Mato Grosso (Box 2), users can register themselves online. However, if the authenticity of information entered is suspect, the administration can ask the user to submit supporting documentation in hard copy format (Chaves, J.H., personal comunication, 2006).

GIS-generated forest management maps are becoming widely used in the forest

In both DOF and the SISFLORA system of Mato Grosso, the new bar-coded timber transport permit (DOF or GF) that is generated electronically replaces the previous (and discredited) ATPF paper transport permit. The new timber transport permits inform road checks about the origin and volume of the logs. Upon arrival at the wood processing plant, the bar-coded document is used to read the information into the system on-line and to generate the 'volume-credit' that industry needs to issue their respective transport permits (DOF or GF2) to transport intermediate products. Compared to the former system, the producer now has the responsibility for printing the DOF or GF and reporting back to the administration, thus reducing costs and bureaucracy. The bar-code individualizes the timber transport permit and protects the system against fraud. The fact that the system is on-line protects it against possible arbitrariness of local bureaucrats and reduces its liability to corruption. In addition, it is now possible to link timber at the industry location to the original logging site in the forest, thus establishing a credible chain of custody that can be verified by spot checks. All the states are legally obliged to give IBAMA free access to this information so that it can be integrated into the federal SISCOM system.

One constraint in using these new systems is access to the internet in remote areas and/or computer illiteracy. However, internet access is expanding rapidly in Brazil. (For example, the public pension system now allows people to access the system on-line, even in remote areas, and receive their pension.) IBAMA plans to provide access to computer terminals as well as assistance for those who use the DOF system, through its regional offices across all the Amazon states.

Another practical constraint is the lack of on-line access to the database at the logging site at the present time. Hence, information about volumes and species need to be determined beforehand, thus reducing the flexibility to take these decisions at the logging site. This demands much better planning of harvesting and timber transport operations, and a level of efficiency and consolidation of the industry that is not universal.

The successful uptake of new technologies in forest governance systems

Based upon the analysis presented above, the following issues appear to be critical for the successful uptake of new technologies in a forest governance system:

Policy issues: what the Brazil case study shows is the significance of buy-in from the highest levels of government. Decisions about technology need to be made at the centre. This is important as the use of new technologies may have

2. *www.obt.inpe.br/deter*

significant cost implications for government. Purchasing commercial satellite imagery or software applications can be expensive, so the benefits to be gained need to be well communicated. Achievements at each stage of the improvement process have to be well understood by the wider public, the media and decision-makers (including the legislature and judiciary). However, technological advance by itself will not bring about improved forest sector governance. The key is to ensure broad appreciation of the improvements made possible by the introduction of new technologies and the uptake of these technologies in the strategies and plans of the forest sector.

Legal issues: A legal framework is needed that recognises the use of new technologies for law enforcement and allows for the conduct of public administration procedures on-line. Neither of these provisions may exist in present legislation. Any strategy to introduce technologies in the state regulatory system must therefore pay attention to early legal reform. Such legislation will not be high up the political agenda if it is confined to the forest sector. More broad ranging reform that encompasses wider elements of the government administration in the uptake of these technologies may therefore be an important tactic in getting such legislation through the legislature.

Institutional issues: Forest control technologies must be integrated with technologies used in the wider government structures (e.g. land tenure, judiciary, tax and revenue). However, such integrated actions are not easy to manage and some type of inter-sectoral commission to oversee the change is likely to be necessary to see them through. Forest authorities must be capable of using these technologies to produce strategic information, if they are to have a visible impact on law enforcement. This may require the creation of new communication units in the forest administration to share information in a way that has not happened before. Private sector participation in the introduction, maintenance and upkeep of new technology should be considered to enhance the speed of implementation. In decentralised scenarios, the concurrent exercise of public competencies can be done with a high degree of efficiency and transparency through the aid of the technological instruments described above. Technologies can assist confidence building and promote decentralised actions.

Technological issues: Technical infrastructure is obviously a prerequisite, so that users can link to the internet. Internet access must be widely available if new systems depend on internet access. One still unresolved problem is access to the internet at the logging site. Many logging camps are just too remote to be accessible to wireless technology. Reliability of access and security of data management are also fundamental prerequisites for any technology-based control system. In order to safeguard these new electronic systems, the forest sector can benefit from looking at the experience of other sectors (e.g. the banking sector) to ensure electronic data protection and security.

Enforcement issues: Law infringements detected using new technological resources often end up in slow bureaucratic sanctioning processes within the administration or the judiciary. Often offences are not sanctioned and the public gets a sense of impunity affecting the whole forest governance system and its credibility. Independent and efficient sanctioning entities and a vigilant civil society are crucial to close the cycle on forest law enforcement if new technologies are to have the desired impact.

Cultural issues: A low level of basic education of rural communities increases the level of dependence on intermediaries or corrupt officials regardless of whether the forest administration works with modern systems or with traditional paper-based ones. Therefore, there is the need to inform and educate all users about the rules and procedures required to harvest timber legally and to offer simple and accessible systems. However, the myth that rural communities are reluctant to use modern technologies and the internet has already been broken, as it is evident by their enthusiastic use of mobile phones and SMS-messages. The introduction of new technologies in the forest sector needs to build on this potential.

What is clear from the experience of Brazil to-date is that the successful introduction of new technologies to improve the efficiency of national forest administration depends on a broad adoption strategy that addresses all of the above factors. As this technology becomes more generally available and internet access improves, the expected efficiency gains will depend on these lessons being replicated elsewhere.

Bibliography

Ministério de Meio Ambiente. 2005a. CONAMA Resolução Nº 378/2006 - "Define os empreendimentos potencialmente causadores de impacto ambiental nacional ou regional para fins do disposto no inciso III, § 10, art. 19 da Lei no 4.771, de 15 de setembro de 1965, e dá outras providências"

Ministério de Meio Ambiente. 2005b. CONAMA Resolução Nº 379/2006 - "Cria e regulamenta sistema de dados e informações sobre a gestão florestal no âmbito do Sistema Nacional do Meio Ambiente-SISNAMA"

Ministério de Meio Ambiente. 2005c. Secretaría de Coordenaçao da Amazonia. Programa Piloto para a Protecao das Florestas Tropicais do Brasil. Sistema de Licenciamiento Ambiental em Propriedades Rurais do Estado de Mato Grosso: Analise de Liçoes na sua Implementaçao. Brasília – DF, 2005.

Thiel, H. and Viergever, M. 2006. Giants don't leap: verification in Brazil's process towards sustainable forestry. VERIFOR country case study No.5. ODI, London.

Neil Bird is a Research Fellow of the Overseas Development Insitute. Hans Thiel is a researcher and VERIFOR Focal Point for South America, based in Quito, Ecuador.

VERIFOR Briefing Papers

Series editor: David Brown (d.brown@odi.org.uk)

Administrative editor: Josephine Tucker (j.tucker@odi.org.uk)

http://www.verifor.org/

This paper is an output from a research project funded by the European Union, under its Tropical Forestry Budget Line, and the Governments of the Netherlands and Germany. The contents of this publication are the sole responsibility of the authors and can in no way be taken to reflect the views of the ODI, the Government of the Netherlands, Wageningen International, the European Union or other donors.