

## MONITORING THE EFFECTIVENESS OF ANTI-POACHING PATROLS WITH MIST

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Evaluating the results of anti-poaching patrols is not easy. What can be concluded, for instance, if results - such as fines, citations and confiscated firearms - drop? This will most likely mean one of two things. A first possibility is that the drop reflects a drop in poaching activities, indicating that the patrol teams have been successful and are doing a good job. However, a second possibility is that the dropping results are caused by dropping patrolling quality, while poaching pressures themselves are stable or even rising.

In other words, for evaluation of anti-poaching efforts it is not sufficient to look at results alone. The efforts that have produced these results must also be measured and taken into account. This is exactly what MIST (Management Information SysTem) has been designed for: measuring anti-poaching efforts and comparing efforts with results.

MIST is a GIS (Geographic Information System) database, meaning that all data are linked spatially. Therefore, MIST makes it possible not only to compare standardized indicators for anti-poaching effectiveness between teams, conservation sites and time periods, but also to view results on maps that show where events occur and how often they occur in certain areas.

Implementation of MIST, along with additional support for anti-poaching efforts, has demonstrated across a number of tiger conservation sites a great improvement in morale and effectiveness of anti-poaching teams, and in at least a few cases, a positive response in tiger numbers.

Implementation of MIST cannot only improve anti-poaching results; it can also influence potential funding streams by providing a transparent monitoring and evaluation system for enforcement efforts. A number of important conservation sponsor organizations have started in recent years to demand GIS monitoring of anti-poaching patrols as a condition for providing grants.

WCS presently works with MIST in tiger conservation sites in 7 tiger range states, including the Hunchun Nature Reserve in Northeast China and Southwest Primorye in Russia. In this paper, we present an introduction to MIST and preliminary results of anti-poaching efforts monitored with the use of MIST in these two sites.

In the following sections of this paper we will:

1. Describe how MIST works.
2. Present anti-poaching results for Hunchun and SW Primorye from MIST data.
3. Discuss how MIST is presently being introduced in PAs in the Russian Far East.

### 1. HOW MIST WORKS

MIST (Management Information SysTem) is a software program that can create and manage a spatially explicit database. All MIST data are linked to a specific time and location that is determined with the use of GPS equipment.

MIST program software is available free of charge and can be downloaded from internet ([www.ecostats.com/software/mist/mistdownloads.htm](http://www.ecostats.com/software/mist/mistdownloads.htm)) and installed on almost any personal computer. The program consists of four modules. The two main modules are MIST GIS and MIST Administrator. MIST GIS is used for entering patrol data into a database and for producing patrol reports and processing data in tables, charts and maps showing patrol routes and results. In MIST Administrator it is possible to program or edit a database structure and customize reporting or data query formats; i.e. here one designs the patrol observation categories and detailed remarks into which subsequent data can be stored. Only standardized data are entered into a MIST database, i.e. data can be entered only by selecting from pre-determined options that have been included in a MIST database designed specifically for that locale. The system maintains a lot of site-level flexibility in designing the database structure, whilst ensuring standardized data collection and data entry protocols.

MIST is a user-friendly system that doesn't require sophisticated computer skills or assistance from a GIS-expert. Entering data into a MIST database is simple and it is also not difficult to produce maps and graphs of patrol efforts and results. However, MIST is a management tool, designed for rapid feedback to site managers and complicated spatial statistical analyses are currently not possible in MIST. If in-depth data analysis for scientific research is the main purpose, then it is advisable to use other GIS software such as ArcView or ArcGIS. MIST data are fully compatible with these applications.

Anti-poaching inspectors use GPS units to document their patrol routes and the relevant incidents and observations during their patrols to specific locations. The patrol teams fill out patrol observation data on specially designed forms.

Theoretically any spatial data can be included in a MIST database, but as a general rule it is advisable to collect only data related to threats to habitat and wildlife and the quality of the anti-poaching patrols. If a wide variety of data are collected, then filling out patrol forms can become time-consuming and distract inspectors from their actual patrol work. For this reason, data collection in Russia has up-to-now been limited to the following topics: 1) poaching, 2) illegal logging, 3) illegal fishing, 4) illegal fires, 5) illegal collection of NTFPs, 6) trespassing into strictly protected area (PAs), 7) illegal NTFP and wildlife trade and 8) leopard and tiger signs and sightings. Examples of categories that we have considered but not included are habitat encroachment, wildlife (besides tigers and leopards) and pollution. The following data about violations that patrol teams uncover are being collected in Russia: nationality and occupation of the violators, their transport means, the nature of the violations (e.g. poaching, illegal logging, collection of NTFPs or fishing), data about citations and related punishments such as fines, damage payments, revoked hunting licenses and confiscation of game, fire arms and other equipment.

It is advisable to have senior staff debrief anti-poaching teams after patrols to check if they have correctly filled in their patrol data forms. As a next step, the co-ordinates of the patrol routes are downloaded from the GPS units into the MIST database. The data on observations and patrol results that were collected on data forms are entered into the database as well. The data that have been entered into the database can subsequently be analyzed and processed into figures, tables, graphs and maps showing the anti-poaching efforts and results. Processed data can be included in standardized MIST reports that are produced on a regular basis; for instance, every month with more detailed reports every 6 and 12 months.

The most important step is the evaluation of the patrol results and providing feedback to the anti-poaching teams with the aim to improve their patrolling. This step is conducted in various ways, largely dependent on the culture and circumstances. However it is recommended to organize monthly gatherings of patrol teams with presentation of MIST results for that period. These meetings can be an effective way to review what was accomplished, assess where problems are, or where there are gaps in the anti-poaching system, and to make adjustments for the following month. Used correctly, periodic reviews can enthuse and energize AP teams, giving them more specific information on what has been done well over the previous month, and exactly what can be done to improve in the coming month.

## 2. MIST RESULTS IN HUNCHUN AND SW PRIMORYE

In this section we provide examples of graphs, maps and tables that were produced with MIST and show anti-poaching efforts and results.

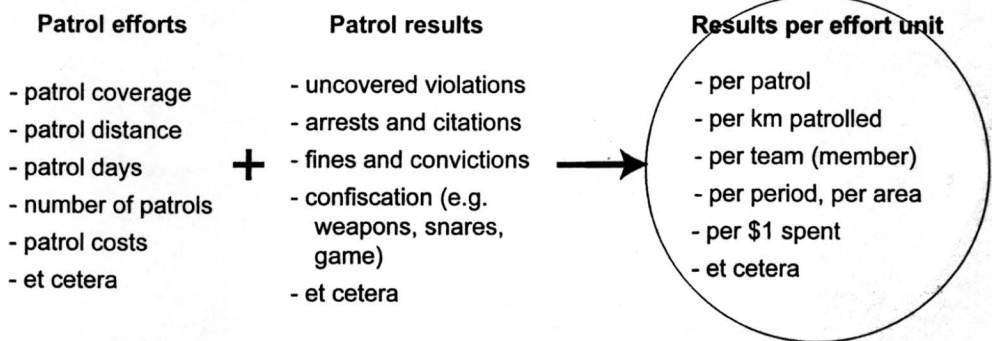


Fig. 1. Patrol quality and poaching indicators

Anti-poaching patrol results form poor indicators of patrol quality and poaching pressures. Patrol efforts, such as patrolled distances and the level of coverage of conservation focus areas, are more reliable indicators of patrol quality. Results based upon effort form good indicators of poaching levels. E.g. when results drop while patrolled distances and coverage have remained the same, then this forms a strong indication that poaching levels have been reduced as a result of the patrols. However, even with use of MIST interpretation of the indicators is not simple; e.g. patrol results per effort unit will also decline when poachers become skilled in avoiding anti-poaching patrols.

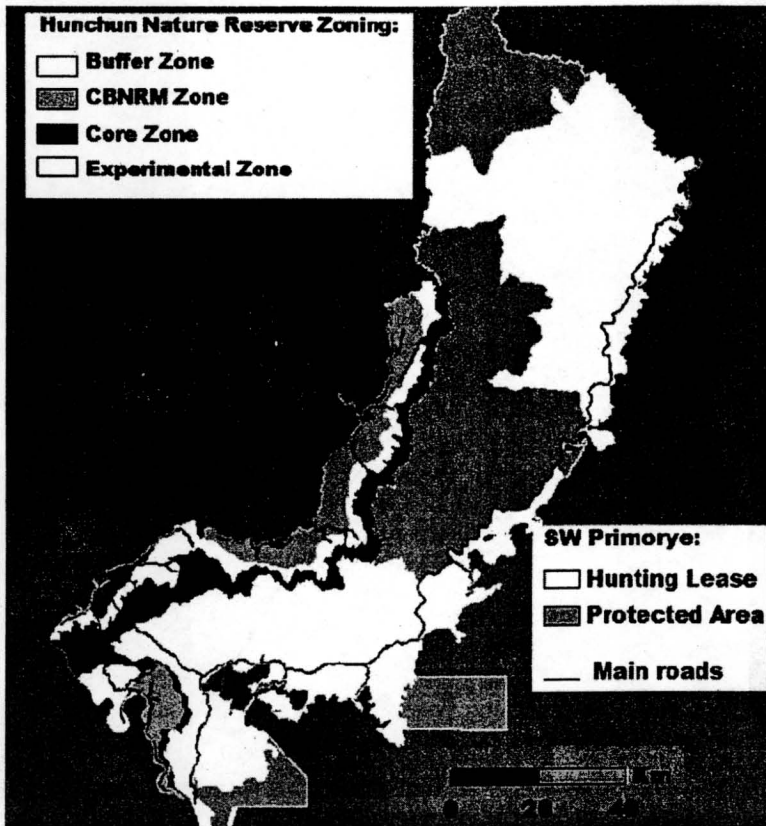
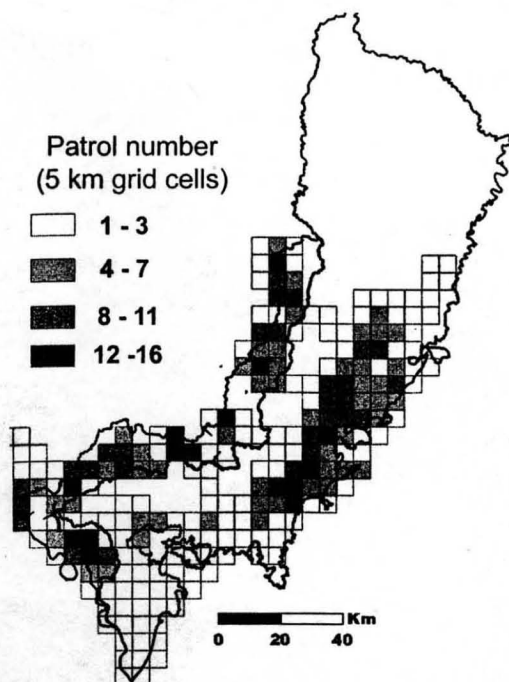
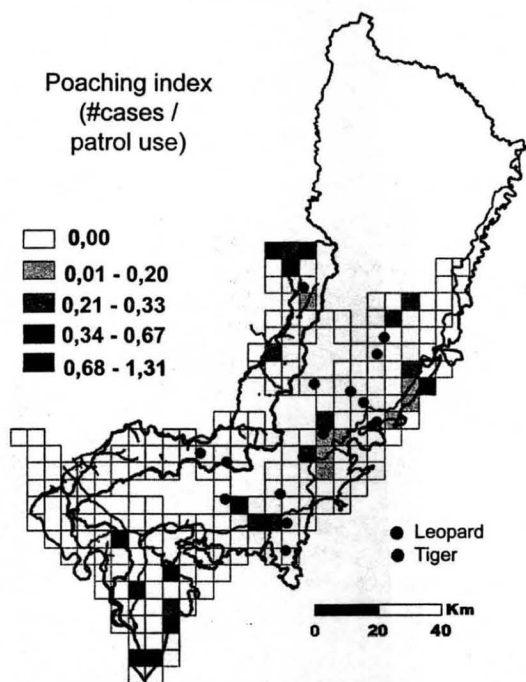


Fig. 2. MIST in China and Russia MIST

MIST has been used in the Hunchun Reserve for monitoring of reserve staff patrols and in Southwest Primorye for monitoring of an anti-poaching team that operates both inside and outside protected areas.

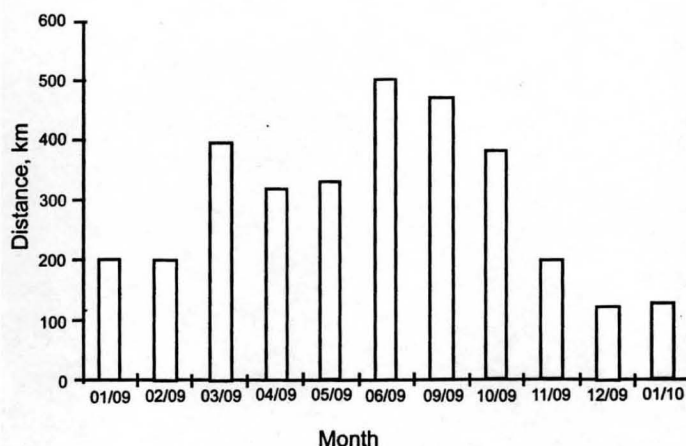


**Fig. 3. Patrol coverage (January - June 2009)**  
This figure shows the frequency of patrols in various areas using 5km grid cells. The area in Russia close to the border was not visited because the patrol team didn't have permission to operate in the border zone.



**Fig. 4. Poaching intensity and big cat signs in SW Primorye and Hunchun Nature Reserve (January - June 2009)**

The big cat signs include sightings and tracks, poaching signs include snares and incidents of illegal hunting with firearms. Areas with both a high poaching intensity and cat signs deserve more than average attention from patrol teams.



**Fig. 5. Patrol distance in Hunchun**  
Patrol distance forms a good indicator of the patrol efforts.

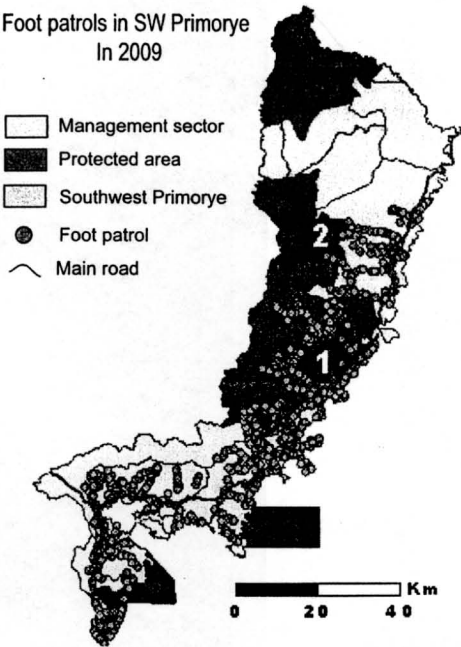


Fig. 6. Foot patrols in SW Primorye in 2009  
The capacity to produce maps of patrol routes is an elementary but important feature of MIST. This Figure shows that the patrol team did not operate in the strictly protected Kedrovaya Pad Reserve (1), which had its own protection teams in 2009. The map also shows that the coverage of Borishovskoye Wildlife Refuge with foot patrols is weak and needs to be improved (2).

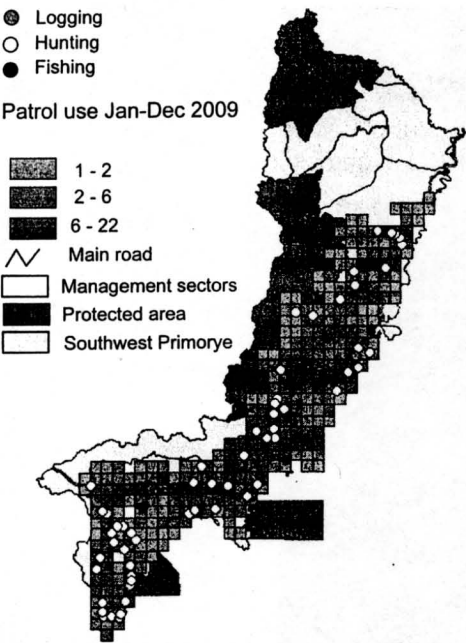


Fig. 7. Violations and patrol intensity in SW Primorye in 2009  
Areas where many violations are uncovered relative to the patrol intensity deserve continued or increased attention from patrol teams.

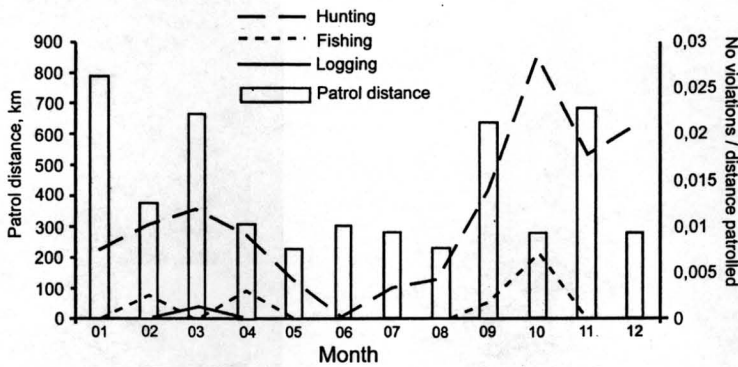


Fig. 8. Number of violations by patrolled distance in 2009  
The total patrolled distance was relatively low in October and December while the number of uncovered violations per patrolled km. was high. It is therefore advisable to increase the patrol intensity in the months October and December.

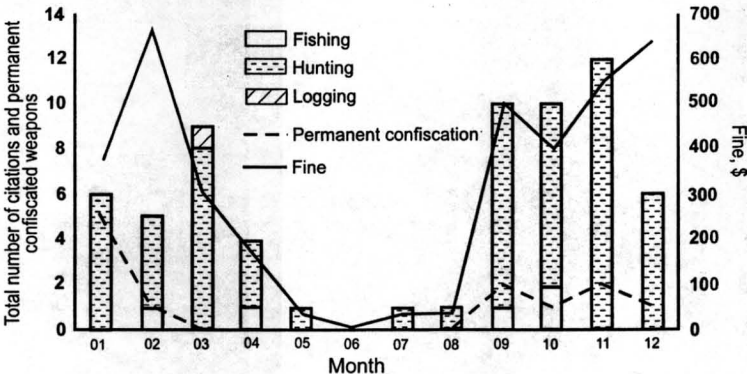


Fig. 9. Number of citations, confiscated firearms and fines in 2009  
Very few poaching violations have been uncovered in summer. Poachers are more difficult to detect in summer and they prefer to hunt when leaves have fallen and visibility has increased or when snow makes it possible to track animals.



### 3. MIST IMPLEMENTATION PROCESS IN PROTECTED AREAS (PAs) IN RUSSIA

WCS Russia and Phoenix Fund co-operate in the implementation of MIST, with Phoenix providing financial support for anti-poaching teams and WCS providing funding and technical support for the introduction of MIST to monitor the activities and results of these teams.

Presently efforts are underway to assist protected areas of the Russian Far East with implementation of MIST. Protected areas are vital "core" regions for tiger conservation, and therefore improvements of anti-poaching efforts in protected areas are vital to security of the entire Amur tiger population. Because poaching inside PAs in Russia is a criminal offence (with serious consequences) effective anti-poaching patrols can act as a significant deterrent to poaching if efforts are of good quality. We believe quality of anti-poaching can improve if there are clear metrics (which MIST provides) and people are rewarded for their efforts.

Below we describe the process of MIST implementation and the introduction of a bonus system to reward AP teams for improving efforts and results.

There are many options for structuring the implementation of MIST, taking into account local circumstances and culture and the organization of anti-poaching efforts in conservation sites. Based on experience in many countries and our experience during a 2-year MIST pilot-project in Russia, we use the following process for introduction of MIST into PAs in the Amur tiger range in Russia:

1. Initial dialogue with PA management.
2. Define roles, tasks, planning and support for anti-poaching teams.
3. Develop a bonus system for anti-poaching inspectors working with MIST.
4. Decide on data categories for data collection.
5. Design the details of the database structure and patrol forms.
6. Purchase GPS units and install MIST on a computer in the PA.
7. Introduce MIST to patrol staff.
8. Initiate training in the use of GPS during patrols and data collection with MIST forms.
9. Train at least two PA staff members in data entry and simple data processing.
10. Start the cycle of data collection, data entry and feedback to inspectors.
11. Further training, first evaluation and - if needed - adjustment of MIST procedures.
12. In depth project evaluation.

#### *1. Dialogue with protected area management*

As a first step in the introduction of MIST in a PA, we discuss options for improving anti-poaching quality with the PA director and deputy director for protection. A first topic for discussion is the current quality and organization of anti-poaching patrols. Related topics include the number of inspectors, their education, skills, motivation and salaries. We discuss the patrol transport means and other equipment that inspectors have at their disposal as well as desired additional technical support needed for improving patrol quality.

Most managers of PAs are interested in improving the quality of protection, but this doesn't necessarily mean that they will all be very enthusiastic about introducing MIST. There can be several reasons for hesitancy, and it is important to understand these concerns and address them. A first concern may be that the management doubts their inspectors are capable and willing to work with MIST. Filling in patrol data forms and documenting patrol routes with GPS units is not difficult, but it involves modest additional work and it requires a capacity to work accurately and consistently. A second possible concern is that MIST results will show that patrol quality is poor and lower than in other PAs. A related issue and possible cause for concern is who will have access to the MIST databases and how the data will be used. PA managers may also fear that MIST procedures result in additional paperwork and will increase the administrative burden of the management staff.

In order to allay concerns as much as possible, we explain that the main purpose of MIST is to improve the quality of patrols. MIST is, in our opinion, not introduced as a means to compare PAs and develop competition between them. We agree with the management of PAs that we will not provide data to third parties - except for needed reporting to sponsors - and that we will not publish data without their explicit prior consent.

## 2. Defining roles, tasks, planning and financial support

During our dialogue with PA management we agree with them on process steps and a planning for the introduction of MIST.

We expect that the more independent PAs are in operating MIST, the more sustainable the use of MIST will be long-term. We therefore train at least two PA staff members in entering data into the PA's MIST database and in simple data processing. This not only decreases our own workload, but - more importantly - it means that data can be frequently entered and that the PAs can do simple analyses (like checking patrol routes) shortly after patrols took place. Another advantage is that the PA staff member who enters data into the database can ask an inspector for a clarification - when his memory is still fresh - if something he wrote on a data form is unclear.

We purchase a notebook computer for each reserve and install MIST on it. The advantage of working with a notebook, rather than a desktop computer, is that, if technical problems occur, the computer can be brought to one of our specialists to solve the problem.

We request that each PA provides a copy of their MIST databases on a monthly basis as well as copies of all the data forms that patrols have filled out. This ensures a backup exists of the database, makes it possible to check if data have been entered correctly, and provides a means of reporting to donors.

Finally, we agree on the level of funding that we will provide for improvement of patrol quality. We offer to cover all costs directly related to operating MIST (such as the costs of GPS units and the notebook computer) and in addition we offer funding for a bonus system for the inspectors working with MIST and for technical anti-poaching support, such as purchase of transport means and other equipment, uniforms, fuel and maintenance.

## 3. Developing a bonus system

Although bonus systems are not appropriate everywhere, we believe that a bonus system for inspectors working with MIST is essential in the Russian Far East. Firstly because MIST creates additional work for inspectors and secondly because one can hardly expect them to do a good job considering their very meager salaries (around \$US 200 per month). We have agreed with PA management on the introduction of a bonus system with the following characteristics.

### MIST Patrol Bonus System

Bonus criteria:

#### A. MIST work

- Quality of filling in data on MIST patrol forms.
- Quality of documenting patrol routes with the GPS equipment.

#### B. Patrols

- Number of patrols.
- Patrol distance (taking in account transport types).
- Areas patrolled (e.g. coverage of assigned conservation focus areas).

#### C. Patrol anti-poaching results

- Number of protocols for poaching, illegal logging, fishing, NTFP collection and trade.
- Total amount of fines and damage payments.
- Confiscations (skins, game, weapons, nets, or other equipment).

The system operate as follows:

1. Only inspectors who work with MIST will receive bonuses.
2. Each month, each inspector is given a mark between 0 and 5 for each of the 8 subcriteria. The score 0 is for poor work and 5 for excellent work. The minimum possible total monthly score is 0 and the maximum score is 40 (8 x 5).
3. Criteria can be given a higher priority if this is desirable to improve certain aspects of the AP work. For instance, suppose the quality of MIST work has been disappointing and needs to be improved. It can then be decided to double the maximum scores for Criteria 1 and 2 for the coming month. In other words: MIST work is made twice as important in the total score.

4. Bonuses are divided proportionally to the scores. In other words, an inspector whose score is 30 will receive two times more bonus payments than an inspector whose score is 15.
5. All inspectors participating in a patrol share equally in its results.
6. Differences in the level of the fixed salaries of inspectors have no influence on the bonuses that they receive (i.e. an inspector with a high salary does not receive more or less than an inspector with a low salary, if they both have equal scores).
7. All inspectors are informed at the start of each month about:
  - The patrol quality criteria and their importance (weight) that month.
  - Their patrol assignments for the coming month (target number of patrols and distance, focus areas).
  - The total size of the available bonus payments for that month.
8. At the start of each month all inspectors are informed about the scores of all inspectors for the previous month. The scores and a draft division of the bonuses are discussed at a monthly meeting with the inspectors. At the end of the meeting the inspectors receive their bonuses in cash.
9. At the end of each year an overview is provided of the total bonuses provided to all inspectors.

#### *4. Deciding on data categories for data collection*

We discuss various options for the selection of data categories for inclusion in the MIST database with the PA management. Defining the data categories is a very important step as it dictates all subsequent steps in the use of MIST.

The data categories that are selected for inclusion in MIST in different PAs do not need to be identical. For instance, if fires are extremely rare in a particular PA and do not form a significant threat, then it can be decided to not collect data about violations of fire regulations. This doesn't mean that these data cannot be included in databases of other PAs.

Any kind of spatial data can be included in a MIST database, but we strongly advise inclusion of only data relevant to patrol efforts and results. In Russia the data categories that we select together with PA management teams are so far all related to violations and to leopard and tigers sightings and signs.

#### *5. Designing the database structure and patrol forms*

When the broad data categories of the database have been determined, the design of the database details ("MIST observation types and remarks") is done by a MIST specialist. For instance, in relation to leopards and tigers observations, inspectors presently collect data on tracks, excrements, hairs, carcasses, kills and sightings. If there are visual observations of animals, data on age, gender, behavior, and habitat where the sighting occurred are collected. At the most detailed level, five habitat types are distinguished for the sightings: forest, open forest, field, settlement and other.

When designing databases for different PAs in a region, it is advisable to keep the observation remarks within observation categories as similar as possible and it is essential to be consistent in terminology. For instance, if one uses the term "arson" as a violation in one database it would be wrong to name the same violation "illegal fire" in another database. MIST facilitates this standardization.

In addition to the observation categories, a number of parameters regarding the patrols have to be defined in the database, namely:

1. The patrol teams.
2. The individual inspectors (it is possible to use nicknames to ensure their privacy).
3. Base camps from which patrols start.
4. Different conservation sectors that are relevant from a management perspective (e.g. because of differences in conservation value or protection regime).
5. Transport means used by patrols (for instance vehicle, snowmobile, motorbikes, and on foot have been distinguished as transport means in Russia).
6. Patrol types, e.g. standard patrol, roadblock, investigation patrol (the latter is a patrol where tips about poaching or illegal trade are investigated).



All these parameters can later be used when selecting data for analysis. For instance it is possible to look at all patrols that started from a specific base camp that was named "North". Or select all data on violations uncovered by a specific team, in a specific PA sector, during motor-bike patrols.

As a first step in the design process, we work out the observation categories and the detailed observation remarks in a WORD document that we discuss with the PA management. When we have agreed on all the design details, we start programming the database in MIST using the module "Administrator Tools".

Finally, we design forms for data collection during patrols. We presently use four forms in Russia:

*Patrol Movement Form:* on this form general information about the patrol is filled out such as the patrol date, the patrol team, the leader, the team members, the inspector operating the GPS unit, the base camp from which the patrol starts and the patrol transport means. The form lists the waypoints (co-ordinates) of the patrol route and the observations made during the patrol (i.e. various violations or various leopard and tiger signs or sightings). Only the observation category is filled out on this form; details are listed on different forms.

*Violation Remark Form:* for details concerning uncovered violations.

*Leopard and Tiger Form:* for details concerning leopard and tiger signs and sightings.

*Sum-up Form:* a lists of all the data forms during a specific period. A "Sum-up form" is included with the sets of forms from a protected area that are delivered to Phoenix Fund each month.

## 6. Purchasing GPS units and installing MIST

We purchase simple GPS units that are sturdy and not expensive. Not all GPS units are suitable; with some GPS brands and types problems occur when downloading co-ordinates into a MIST database.

We install MIST on a notebook computer that we have purchased for use in the PA. We also upload maps of the PA and surrounding areas into the MIST database using shape-files with features that could be relevant for data analyses, such as conservation sectors, relief, settlements, roads, wildlife monitoring data and habitat types.

## 7. Introducing MIST to patrol staff

As a next step, the PA management informs the protection staff about the introduction of MIST for monitoring of their anti-poaching patrols. The management informs the inspectors about the criteria in the bonus system, the total amount of bonuses that will be divided each month and about a training period before the "official" start of data collection.

## 8. Initial training in the use of GPS units and data collection with forms

In Russia we initiated use of MIST with a single anti-poaching team in 2008. The leader of this team already has the capacity to provide training to other AP teams in the use of GPS units and in data collection.

As a first step, the Russian instructor explains what type of data can be filled out in various sectors of the data forms. In addition to the data forms, the instructor hands out a list with standardized observation remarks from which the inspectors can select when filling out data forms. Included are lists of various violation types and other observations as well as lists of NTFP -, tree -, bird -, and mammal species. E.g. only mammal species included in the mammal lists can be filled out in the sections "leopard and tiger kills" or "confiscated animals".

As a second step, the instructor describes incidents that can occur during patrols and asks the inspectors to fill in corresponding data remarks on the forms. A realistic incident could sound as follows: "Suppose that, while driving in sector North, you hear two gunshots from a distance of about 1-km to the south. While driving in that direction you spot a man with a gun in the forest. He runs away, but you run after him, and when you catch up with him you need to use force to detain and restrain him, but fortunately nobody gets hurt in the process. His shotgun turns out to be unregistered and is confiscated. When searching the area, his car is found hidden in thick vegetation in the forest. A total of 20 cartridges are found in his car together with a roe deer that has

been killed recently, outside the hunting season. As a result of his violations this Russian police officer receives an administrative fine of \$US 400". All the details in this story should result in data correctly filled out on a data form.

As a third step in the initial training the instructor goes out on patrols with the various PA teams and teaches them to register their patrol routes with GPS units. The co-ordinates from the patrols are subsequently downloaded into the MIST database in order to verify if the patrol routes show up clearly on MIST patrol maps.

### *9. Training PA staff in data entry and simple data processing*

Experienced Phoenix staff show the PA staff members how to enter data into MIST. Unfortunately, presently the MIST user interface is only available in English, but there are plans to develop versions in other languages, including Russian. In order to make data entry easier, we have developed a dictionary with Russian translations of all English terms in the database. In addition to data entry, we also teach the PA staff how to produce simple tables and maps in MIST of the patrol routes and results.

### *10. Starting the cycle of data collection, data entry and feedback of results to inspectors*

When all the described preparations have been concluded, the PA management announces the date when MIST will be launched. We urge the PA management to provide clear patrol assignments and targets to all teams and inspectors before the launch date. Most importantly there should be targets for patrol frequency, distance and conservation sector coverage both at the level of patrol teams and individual inspectors.

In the first few weeks after the start of MIST, the PA management should frequently check – in co-operation with the staff that enters data into MIST – if patrol forms have been filled in correctly and if patrol routes have been documented well. Data should be entered frequently into the database and, if asked, the staff members who enter the data should be able to inform inspectors and team leaders at any time if they are on target in meeting their patrol assignments for that month.

When data have been collected during a full month and have been entered into MIST, a copy of the database is sent to Phoenix Fund where processing of these data is conducted. There are many options for processing and presenting data and we discuss various options with the PA's management team. Eventually this results in standardized formats for monthly, 6-monthly and annual MIST reports of a PA's patrol efforts and results. Of course, it is possible to do additional in-depth analyses of aspects that are not covered in standardized reports.

The MIST reports include tables, graphs and maps of the results of teams and individual inspectors regarding the bonus criteria 2 to 8. In addition we provide scores for criterium 1 (quality of filling in forms) based on examination of the data forms. We establish if they have been filled in clearly, completely and with use of the correct standardized remarks.

We discuss the MIST results with the PA's management and, if needed, assist them with their evaluation of the patrols and development of instructions for improving patrol quality. Ideally outside advisors can participate in the first several monthly meetings where the management provides feedback about the MIST results to the inspectors and informs them about their new targets and focus points for improvement for the coming month. The bonus system scores are discussed at these meetings and the monthly bonuses are handed out in cash.

It is essential that these monthly review sessions are institutionalized at the protected areas operating with MIST.

### *11. Further training, first evaluation and - if needed - adjustment of MIST procedures*

We attempt to provide additional training by anti-poaching and MIST specialists who have worked in many countries. Such training is best done after 2 to 3 months of experience by local teams in collecting data for MIST. In addition to inspectors with experience, a limited number of patrol team leaders from PAs where MIST has not yet been introduced can also participate to

learn how to work with MIST. These inspectors can later assist our Russian instructor when he conducts initial MIST training in these PAs.

We participate in the additional training sessions. Suggestions from the trainer and discussions with the inspectors during the sessions can result in improvements of the MIST procedures (e.g. changes in the design of data forms and database).

### *12. In-depth project evaluation*

A year after we launch MIST in a PA, we will conduct an in-depth evaluation of our MIST project and provide answers to the following questions:

1. Has the introduction of MIST, in combination with technical support and the bonus system, resulted in a significant improvement of the quality of anti-poaching patrols in the concerned PAs?
2. Are the MIST procedures that we have designed satisfactory? E.g. the database structure, data forms, arrangements for data entry, analysis and feedback? What improvements are possible in these procedures?
3. Are the technical support and the bonus system satisfactory? Is all our support still required? What improvements are possible?
4. Is the 12-step process for introduction of MIST in Russian PAs – as described in this article – effective? What improvements in the process are possible?

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