

Climate change threatens plant diversity in Bangladesh

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FORESTS cover one third of the earth's surface and estimation is that more than two thirds of all available terrestrial species are found in the forests. Bangladesh also supports a wealth of plant diversity and is located in transition of two mega-biodiversity hot spots of Indo-Malayan region. The country has been endowed with rich plant diversity because of its fertile alluvial land, warm and humid climate. More than 5,700 angiosperm species and several sub-species are available in Bangladesh. The diverse agro-ecological (30 agro-ecological zones) regions or the 12 Bio-ecological zones of the country have sustained rich genetic resources of crop plants, which are unique to this country. The forest of Bangladesh covers approximately 2.60 million ha which is about 17.62 percent of the land area of the country. Of these, the hills consist of moist tropical evergreen and semi-evergreen forests, which extend from northeast to southeast of the country. The forests are generally uneven-aged and multistoried with the valuable

tropical species of Dipterocarpus, Swintonia floribunda, Aphanamix polystachya, Artocarpus chaplasha, Tetrameles nudiflora, Duabanga grandifolia and Pterygota alata. The understorey is a tangle of shrubs, creepers, climbers, ferns and orchids. The species were adapted to the different ecosystems after a long successional process.

Though the native plant species of the country have been enriched with new species and varieties introduced from abroad, but the invasive plants are becoming a major threat to natural ecosystems and their species. The impacts of alien invasive species are immense, insidious and usually irreversible. The scope and cost of alien invasions is global and enormous, in both ecological and economic terms. But, unfortunately in Bangladesh introduction of alien invasive species of flora were deliberate primarily in order to increase productivity to support the needs of a huge population. The deliberate preferences of fast growing high yielding cultivars eroded some of the native species and the genetic resources abruptly. We have scarce

In Bangladesh, due to population pressure, deforestation and changes of land use pattern, many species of both flora and fauna have become extinct and many more species are categorized as threatened or endangered considering their existence in wild or cultivated form. In addition, Bangladesh will face serious consequences of biodiversity loss from the global climate change. Considering the present situation and future need, Bangladesh must address the problem of extinction of her native plant resources.

information about the alien species in Bangladesh and their impacts on the ecosystem and the species.

More than 300 exotic species are supposed to be either wild growing or cultivated as an economic crop in Bangladesh. Some of the invasive plants are so well established that have become noxious weeds of forests and wastelands (Chromolaena odorata, Mikania cordata, Lantana camara etc.). Some are considered as noxious weeds of cultivated fields also (Alternanthera, Scoparia and Heliotropium spp.). Some troublesome weeds are also found in water land, e.g. Eichhornia crassipes, Pistia stratiotes. The British mostly contributed to the introduction of some economically important forest plants from almost all the continents, e.g. Tectona

grandis, Paraserianthes falcata, Albizia saman, Xylia dolabriformis, and Swietenia macrophylla. In the 20th century this trend continued to be the same, and some Australian species (Eucalyptus camaldulensis, Acacia mangium, and Acacia auriculiformis) are getting preferences in the plantation programs. Of these, the Acacia auriculiformis is dominating in all the plantation programmes and growing well in all sorts of degraded lands.

Global climate change is now a reality and the change is mainly happening due to global warming. Global warming is an issue of much concern for both the developing and developed countries. The atmospheric concentration of some gases, mainly carbon-di-oxide has increased and it forms a layer that

traps the heat of the terrestrial radiation. Consequently, the earth temperature is gradually increasing and projection is that the global temperature will increase by 1.5 – 2.8 degree Celsius by the middle of this century. The IPCC calculation projected that if carbon-di-oxide is doubled in the atmosphere, the mean temperature of the earth will increase by 1.5 – 4.50C. The IPCC also forecast that global temperature would rise by 0.20 – 0.500C in each decade during 21st century with a consequent rise of sea level by 3 – 10 cm. Temperature rise will result in melting ice and consequently the sea level will rise up to 70 cm! The detailed glacial record in Greenland and Antarctica indicates that the global climate has changed remarkably within the last couple of decades.

Global climate change has an adverse effect on sea level rise, increase in force and frequency of floods, tropical cyclones, tornadoes, drought, rainfall, intrusion of salinity, soil erosion, and loss of biodiversity and total degradation of the environment. Moreover, the incidence and extent of malaria, dengue and some other vector borne diseases are expected to increase with global warming. The effects of sea level rise and flooding of the low lying coastal areas threatens the shelters, resources and livelihoods of several million people in the world. Similarly, a huge population (about 30 million) of Bangladesh living along or very close to the coastal area will suffer severely. Reduction of fresh water flow and salinity increase in the Sundarbans has already

resulted in top dying of Sundri trees and gradual changes of the forest composition. If the situation keeps on prevailing or worsens, then Sundri, the climax species of the Sundarbans may be replaced by some other species.

Temperature increase by one degree significantly lowers the production of wheat and potato of the country. Adverse environmental changes will also affect the production of the major crop rice significantly. Evidence exists that climate change is seemingly changing the existing forest covers significantly. Small changes in temperature and precipitation significantly affects forest growth; even an increase of one degree in temperature can modify the functioning and composition of forests. Forest dwelling large animals and 9 percent of all known tree species are already at some risks of extinction. Climate change also threatens the forests by pests and fires, making them more vulnerable to invasive species. Deforestation and land clearing activities emit about 1.7 billion metric tons of carbon per year into the atmosphere. Hence, conservation of forests offer important opportunities to protect biodiversity and slow climate change.

In Bangladesh, due to population pressure, deforestation and changes of land use pattern, many species of both flora and fauna have become extinct and many more species are categorized as threatened or endangered considering their existence in wild or cultivated form. In addition, Bangladesh will face serious consequences of biodiversity loss from the global climate change. Considering the present situation and future need, Bangladesh must address the problem of extinction of her native plant resources and immediately needs collection, conservation and management programme for future vulnerable catastrophic climates. Scientists, policy makers, administrators, civil society and public representatives including political leaders could play a vital role to save the diverse plant resources from extinction. Regional and international cooperation with countries have much to gain from partnership in research and development programme devoted to the conservation and use of plant resources.

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Natural hill forests with many native tropical tree species



Clearing the high forests for jhum cultivation



Encroachment and unscientific use of the forest lands



Changing microclimate accelerates the growth of alien invasive weeds

Conserving the Sundarban tigers

ADAM BARLOW

THE tiger is arguably the most magnificent and recognized of all animals, but is facing a very real risk of extinction in the wild. As human populations continue to soar, the tiger's forest home has reduced to about 7 percent of its former extent. This severe habitat destruction as well as poaching and prey depletion has reduced tiger numbers to probably less than 5,000 worldwide. In Bangladesh, this same forest destruction means that less than 10 percent of the country remains forested and the Sundarbans makes up around half the remainder. The Sundarbans ecosystem is essential for human existence, supplying oxygen, absorbing greenhouse gases, regulating weather patterns, protecting the country from cyclones and securing sources of fish, goat, wood and honey. The tiger is an integral part of the Sundarbans ecosystem and its protection will also secure the protection of its forest home. The tiger is also the national symbol of Bangladesh and often referred to in the country's literature. Conserving the tiger both in its own right and as guardian of the Sundarbans, will therefore preserve a cultural icon and help protect humans and their livelihoods. So, if we understand the tiger's importance and the threats it faces then why do tiger numbers continue to plummet, and what can we do about it?

One option is to do nothing and hope that the problem will go away. This option will of course lead to the certain demise of tigers. Fortunately there is another approach and one employed by tiger conservation projects worldwide in an international effort to save the tiger. For tigers to have a fighting chance of survival we need to collect the necessary information to formulate and implement sound management decisions. Trying to manage a tiger population without any information is like trying to manage a business without any idea of your customer's (tiger's) needs, how many customers (tigers) you have, what your rivals are doing (threats to tigers) or even if what you are doing is making a profit (counted by the number of tigers).

The fate of the Sundarbans tiger population is jointly determined by the Forest Department, the local people that live next to and use the forest, and the general public. All have a role to play in being custodians of the forest and its biodiversity.

The Daily Star article by Sirajul Hossain entitled "Death of two tigers: Immature science in immature hands" (22nd February, 2008) commented on the Sundarbans Tiger Project collaring activities and the use of the drug Telazol in tiger tranquilization. It also included criticisms of the use of snares, the use of cows as bait, the people involved and other project work. Unfortunately the article did not include available information on these issues that would help the Bangladesh people decide if collaring tigers is a useful management tool, and if Sundarbans Tiger Project is of benefit to tiger conservation in Bangladesh.

The Sundarbans Tiger Project is a joint venture between the Forest Department of Bangladesh and the University of Minnesota that has been set up to help ensure the long-term protection of tigers in Bangladesh. The project aims to achieve this goal through a combination of research, capacity building and conservation awareness. So far the project has successfully collared two Sundarbans tigers that provided valuable information on home range size, habitat requirements, behavior, movement

patterns, predation rates and population carrying capacity. None of the tigers died or showed any abnormal behavior as a result of being collared, and through that research we now know that Sundarbans tigers may have some of the smallest home ranges of any wild tigers anywhere in the world. A small home range size means a high tiger density, which emphasizes the Sundarbans tiger population as globally important for the conservation of this species. In early 2007 the project carried out the first complete and scientifically sound survey of relative tiger abundance in the Sundarbans. This survey will be repeated every two years and changes in tiger abundance will be used as the measuring stick to evaluate if protection measures are working or require improvement.

As of January 2008 the project is conducting a prey survey to also start tracking changes in the deer population. The project has created the Forest Department Sundarbans Handbook which is being distributed for free along with training to every Forest Department personnel working inside the Sundarbans. The project's involvement with the BBC Ganges program and another program currently being filmed on tiger-human conflict is aimed at raising international awareness about tiger conservation issues in Bangladesh.

To raise further awareness, the project staff have given numerous talks to villagers, universities, government departments and the general public. Two new books are being made to be given out free to thousands of villagers; one book is aimed at children discussing some important aspects of tiger conservation, the other is aimed at general people living next to the Sundarbans and contains information on tiger behaviour, ecology and conservation. To deal with problem of tigers, the project is training Forest Department Tiger Response Teams to deal with man-eating and livestock killing to relieve economic hardship and unnecessary human misery for local communities and to decrease incidents where tigers are killed by villagers in retribution.

To address specific concerns raised about collaring, it is first important to consider that in any operation involving anaesthesia, human operations included, there is a risk of death. In these situations we make a decision to proceed based on the risks of the anaesthesia versus the benefits that the operation will bring. This is exactly the same decision made when anesthetizing a tiger in order to fit a collar; the benefits, in this case to the species, must outweigh the small risk posed by the tranquilization of the individual tiger. There are two main justifications of using collars. The first is to gather information on territory size, how many tigers an area can support, and what resources, like forest type and prey species, are important to ensure tiger survival. This information from collaring a few individual tigers can help conserve the entire population by guiding management strategy for protection and threat alleviation. For example a tiger project in Russia has used collaring data to help increase the tiger population from about 100 tigers to over 400 (<http://www.wcs.org/asia/siberiantigerproject>). The second reason is to save people, livestock and tigers by collaring problem tigers so that, by knowing where they are on a daily basis, we can help people avoid dangerous areas and stop the tiger entering a village where it is often killed. For example, in Kenya a project has used collars to greatly reduce the

number of lions and livestock being killed in a very similar conflict scenario (www.lionconservation.org).

Several tiger range countries have already chosen to use collaring to help long-term management efforts to protect tigers. Collaring tigers has been going on since the 1970's when the first tiger was captured in Nepal. Since then over 100 tigers have been captured in collaring operations in countries such as India, Russia, Nepal and Thailand. If a country decides to use collaring, then it is necessary to use the best tools available considering the particular field conditions. For collaring, this includes consideration of how to catch the tiger and what drug to use.

The previous article presented some quotes and references that suggested Telazol was dangerous for tigers because it could cause death or in some cases damage to the central nervous system. The references used were either suggestions not to use Telazol or pointed to unnamed reports. None of these references, however, present any actual data to support the claim that either a single wild tiger has ever died or shown abnormal behaviour due to Telazol metabolism. To verify that either of these claims are true, one would expect to see some evidence gathered from either experiment or field experience. No such evidence was presented.

So why then do the quotes to which Sirajul referred mention there being danger associated with the use of Telazol in tigers? I posed the question to Dr Terry J. Kreeger, supervisor of the Wyoming Game and Fish Department's Veterinary Services Branch. Dr Kreeger is a renowned specialist in wild animal immobilization and has written the "Handbook of Wildlife Chemical Immobilization" kept regularly up to date with new findings from the field. Dr Kreeger has also published over 60 scientific peer reviewed papers, articles and reports on immobilization, animal physiology and disease. I supplied him with all the information on the two collared Sundarbans tigers together with a copy of the news article by Sirajul Hossain. Dr Kreeger's reply is below. Note that F1 is the short name of the first tiger collared in the Sundarbans "Jamtola Rani", F2 is the second "Chaprakhal Rani". The capitalizations are Dr Kreeger's own:

"Well, based on what information that I have, there is no way F1 died from being immobilized when the immobilization took place 6 months previously. There also does not appear to be any evidence that F2 died shortly after the second immobilization. Now, the bigger question is all the quotes saying that Telazol should not be used on tigers. Just last week, I was reading the chapter on feline immobilization in the new Zoo Animal & Wildlife Immobilization and Anesthesia book by West, Heard, and Calkett (pages 443 and 445-446). In that chapter, the same warning about tigers and Telazol was given. I looked up the 'references' for that warning and they provided no data. This whole 'myth' in zoos inexplicably died immediately (i.e., within an hour) or a few days after being given Telazol. As far as I know, there have been no studies in tigers to address this phenomenon. With that said, the same warning about tigers and Telazol was given in the first and second editions of my Handbook of Wildlife Chemical Immobilization. However, I have been totally unable to secure first-hand references, reports, or other documentation that supports this warning. Most so-called reports are merely repeating previous undocu-

mented claims. And of course, there have been no controlled research studies to examine the effect of Telazol on tigers. Being unable to verify or document that 'post recovery neurological problems' have definitively been linked to Telazol or are even still observed these days (remember, Telazol has gone through a couple of formulation changes), I opted to drop the warning in the 7th edition of the Handbook because it simply cannot be verified."

Dr Kreeger also mentioned that there is a report from Omaha Zoo by Armstrong who noted adverse effects on captive tigers from Telazol, but once again he could find no verifiable evidence to support the claim. Furthermore, although wild tigers have been darted in the wild since the 1980's with Telazol, there is no documented case I can find that records a death or adverse effects related to the drug's metabolism in the subject animal. For example in Nepal a total of 26 individual tigers were darted with Telazol (called CI-744 in the article) for a total of 50 times (Smith 1983). The following is an extract from the paper:

"Tigers had a wide tolerance for CI-744, and its overall performance

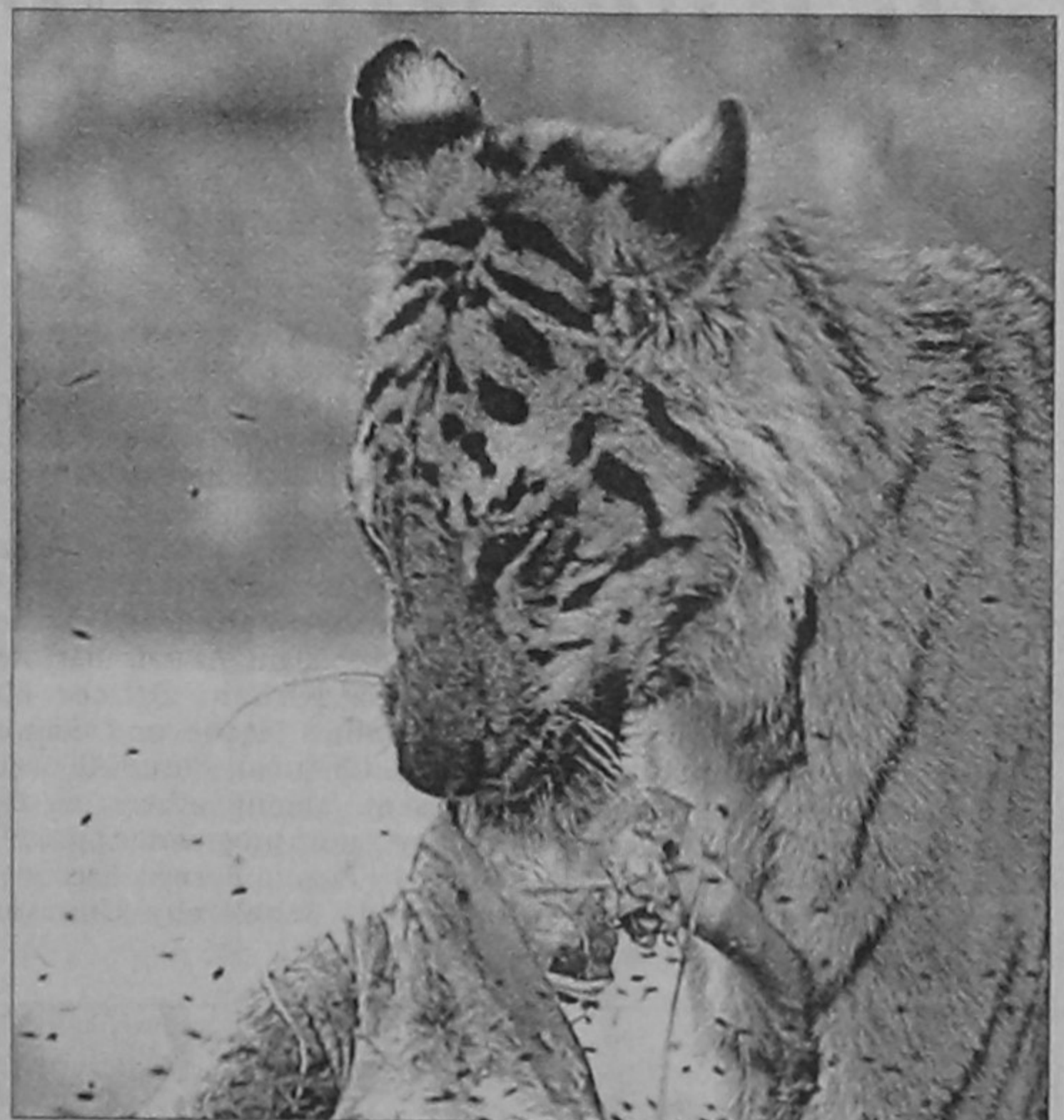
two tigers in Thailand. All tigers made full recoveries to their pre-tranquilized state, returned to the wild and continued their normal life in the jungle. Telazol is also a well established drug for immobilization in general and has been used on a wide range of animals including polar bears, horses, pigs, monkeys, ostriches, rabbits, leopard cats and leopards."

Sirajul's article also references Dr. Karanth's work in India:

"Dr. Ullas Karanth started tiger research in Nagarhole reserve forest in India using chemical immobilization and radio collaring. After the death of several tigers the Chief Wildlife Warden of India (same as our CCF) cancelled his permission for that fatal research."

In fact no tigers in Dr Karanth's study died from either capture, immobilization or collaring. (Karanth, K. U., and M. E. Sunquist. 2000. Behavioural correlates of predation by tiger (Panthera tigris), leopard (Panthera pardus) and dhole (Cuon alpinus) in Nagarhole, India. Journal of Zoology (London) 250:255-265.)

I would, however, point out that tigers have died during immobilization procedures but for reasons other than Telazol metabolism or snare injury. In 30 years of



Chaprakhal Rani feeding after collar removal

appeared to be superior to other drugs used for large cats (King et al. 1977). We immobilized with dosages from 3.1 to 11.7 mg/kg (Table 1). The maximum used, 11.7 mg/kg, was administered to an 86-kg male cub; the animal showed no signs of respiratory depression or loss of licking and blinking reflexes. It recovered (stood and moved into cover) within 5 hours."

"We found no evidence that darting or repeated dartings had adverse effects on either the behavior or physiology of tigers. After animals recovered from anaesthesia, about 60 percent returned the same evening to feed on their bait-kill. No tiger altered its use of space or showed a change in either social or reproductive status. Three females immobilized in their last month of pregnancy subsequently bore litters and successfully raised them. One adult male captured during a mating association with an estrous female resumed this association within 12 hours." (Smith, J. L. D. 1983. A technique for capturing and immobilizing tigers. J. Wildl. Manage. 47:255-259.)

I have personally used Telazol to dart two tigers in Bangladesh and a further

response to another female tiger that took over her territory and she later died; a normal event for an old female. Chaprakhal Rani was recaptured 9 months after her collaring. She was weak because her bad teeth did not allow her to feed efficiently. She was released alive back into the jungle and observed for 3 consecutive days as she came back to feed off the same bait with which she was captured.

With reference to animal immobilization Sirajul's article also notes: "For wild animal the research is very difficult and often not permitted in most countries. Which is specially true for endangered and rare species" ... "It struck in my mind that somewhere I read that tranquilizing wild tiger can be fatal to the animal and that's why it has been stopped in many countries and not permitted anymore."

Firstly, the article does not list a single country that has stopped wild animal tranquilization. As anyone can discover through a brief internet search, immobilization of wild animals is a common practice in many countries. In fact, it is usually endangered species that receive more collaring attention to gather information to help save those species. There are projects catching, immobilizing and tracking tigers using collars right now in Russia, Thailand and India. Of particular note is the recent (December 2007) collaring of a female tiger in the Indian Sundarbans for research purposes, and they are busy trying to catch more.

With regards to snares, the Sirajul's article reads: "Traps and snares can injure tiger and that could be enough for the end of their life."

Common minor injuries from snaring include cuts or swollen feet but swelling goes down after removal of the snare and minor injuries will heal. The assertion that injuries sustained are enough to kill the animal is not backed up with any reference whatsoever and is not supported by experiences of researchers in the wild; there are no cases that I am aware of that document tigers dying as a result of snaring in the wild in Thailand, Russia or now Bangladesh.

A Russian study including 23 snare captures concluded, "We developed safe and effective capture techniques for Amur tigers despite their low density, large home ranges, and unpredictable movements.... These techniques allowed us to launch a successful radio tracking program on a species whose secretive nature and dense habitat make them otherwise difficult to study." (Goodrich, John M. et al. 2001. Capture and Chemical Anesthesia of Amur (Siberian) Tigers, Wildlife Society Bulletin, Vol. 29, No. 2)

A study of the use of foot snares in Africa that caught 27 lions concluded that the method was both effective and safe. "Importantly, foot snares produced no significant detectable injuries in lions other than transient edema." (Frank, L. Simpson, D. Woodroffe, R. 2003. Foot snares: an effective method for capturing African lions. Wildlife Society Bulletin 31, 309-314.)

With regards bait, Sirajul stated "Researchers are using live cows as bait, which can infect wild species with new disease." However, Sirajul fails to mention a disease that he thinks is either present in the domestic cow population, or has ever been documented as spreading to wild tigers. More importantly, Sirajul did not mention that tigers already kill many domestic animals every year in the villages bordering the Sundarbans. If there is a disease present in the domestic cow population that could spread to the wild tiger population then it would have done so already. In any case, the

project vaccinated cows used as bait away from human habitation.

"Dr. Karanth and many of his foreign partners seem very eager to tranquilize wild tigers maybe want to finish their incomplete research which failed in India. The tiger radio collaring project in Bangladesh was motivated by the group of experts who are very keen to do research where getting the permission for it is easier. In an interview with the famous Indian technology magazine "Dataquest" Karanth said in June 2007: "The biggest issue in use of technology, say radio telemetry or chemical immobilization, is the problem of getting research permissions."

First of all, tiger collaring for research has not "failed" in India. Collaring operations have been carried out in Panna, Nagarhole, Khana, Ranthambore and continue on the Indian side of the Sundarbans, where a tiger was collared just recently. Secondly, the article is questioning the motivations of Dr. Karanth and his "foreign partners" (who are, by the way, not listed). This, I think, is an unnecessary attack aimed at Dr. Karanth who is an internationally renowned tiger scientist and who last year was awarded the Getty prize for lifetime contribution in tiger research and conservation. In any case, Dr. Karanth is not presently working on tiger conservation in Bangladesh, so it is hard to understand why he was included in the article.

"But even after inflating the project paradigm in such a vast forest like the Sundarbans, the project working manpower remained the same -- the PhD student Adam Barlow, one forest guard, one speedboat driver and three helpers who had no prior experience and no considerable education."

We have core staff of two trained Wildlife Technicians who have now 3-4 years of experience working on tiger research in the Sundarbans and the project is proud of the fact that they are local people, one of whom despite losing his brother to a tiger, remains dedicated to the cause.

After all, it is the local people who are living with tigers on a daily basis. I am unaware of anyone else with as much field experience conducting tiger research in the Sundarbans than these two staff members. The project staff work closely with Forest Department staff such as CF's DFO's, ACFs and Foresters and all operations are overseen by Forest Department officials. We also have volunteers and staff from the environmental departments of Bangladeshi universities.

"Many local people reported and in the BBC film 'Ganges' it was commented that both the tigers showed abnormal behaviour and there were reports of attacking people."

The "many local people" mentioned are neither named nor verified. The Ganges program does not mention any abnormal behaviour resulting from any collaring operation and the BBC themselves wrote to The Daily Star to correct this misinformation.

"Even the first tiger jumped over Dr. Tapan Kumar Dey, DFO and his team when they were trying to photograph it collaring. They jumped on the nearby pond to save themselves in Kuchikhal."

I assume that this is in reference to an incident where the tiger growled at some Forest Department staff that got too close whilst taking a photograph. This was a mistake, but neither the people or the tiger were harmed in any way. Furthermore, the incident was not during the collaring, the tiger did not jump over anyone, and Dr. Tapan Kumar Dey, DFO was not one of the party! "Thick canopy like the Sundarbans

may also impair GPS function and can put a lot of void in data."

Collars include both GPS (satellite) and radio technology so that location data can be collected via satellite and also directly in the field via handheld radio receivers. Approximately 650 and 1500 GPS locations of each tiger were collected respectively. This is more than adequate for analysis purposes and the results are currently being written up in detail.

"The same research can be done with camera trapping (like Trail Master). Camera trapping is allowed everywhere and used worldwide without any harmful effect on the species for similar research."

The aspect of research to which the sentence refers is not stated. With regard to tiger research in general, however, in some scenarios camera trapping can give data on tiger abundance, but the technique has been already carried out on the Indian side of the Sundarbans and was assessed as impractical for use in this habitat type. (Karanth, K. U., and J. D. Nichols. 2000. Ecological status and conservation of tigers in India. Final technical report to the US fish and wildlife service, Washington DC, and Wildlife Conservation Society, New York. Center for Wildlife Studies, Bangalore, India.)

To conclude and based on the available evidence, it is useful to answer the following questions: Is there a risk to individual tigers from collaring? I would say absolutely, but the risks are very small. Will the whole tiger population suffer if management is lacking information collected from collaring? I would say definitely. In cases of human-tiger conflict, will people and tigers suffer if collaring is not used as a management tool? I would say undoubtedly. India, Russia, and Thailand continue to use this tool to further tiger conservation. If we choose not to use collaring then we also choose to accept continued loss of livestock, people and tigers.

I hope, for the sake of the tigers, that there will be no further unbalanced attacks the media that are at best divisive and at worse damage tiger conservation. It is much easier to criticize other people's efforts to save the tiger than to create solutions or come to work in the forest to help save tigers. While we debate tiger darning in the newspapers for example, more cows and dogs have been killed in Chandra where we were trying to collar a problem tiger. The same tiger has killed over 60 domestic animals and one person. Livestock depredation by tigers is common in the eastern Sundarbans and man-eating is rampant in the West. Surely these kinds of issues deserve more attention in the newspapers. As recorded by the BBC news regarding Sirajul's article "According to Raghuraj Chundawat, a Delhi-based wildlife scientist who is not connected to the project, any long-term suspension of the radio-collar programme would be a 'disaster' for the Sundarbans, and doubts about the safety of the drugs are 'absolute nonsense'." What does it achieve to attack people's efforts to conserve tigers in the press? I think that the Forest Department's efforts to save the Sundarbans tigers should be highly commended. The tigers' only hope is that people can work together in a constructive way and I ask the Bangladesh people to unite behind tiger conservation before it is too late."

Adam Barlow is with the Sundarbans Tiger Project. The full referenced article is available on www.sundarbansproject.org info