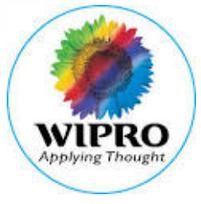
2015 VOL 9 ISSUE 4

current conservation

The magazine is produced with support from:



Current Conservation carries the latest in research news from natural and social science facets of conservation, such as conservation biology, environmental history, anthropology, sociology, ecological economics and landscape ecology.

For more details, visit our website at www.currentconservation.org

contents

Cover art by Archana Sreenivasan

Climate change has been one of the most polarizing issues in contemporary debates about environment and conservation. Hence, it came as a pleasant surprise that nearly 200 countries were able to come to a reasonable agreement about the way forward at the Paris conference in end 2015. Matt Creasey provides a broad overview of the ecological impacts of climate change and the role that the recent talks may have in mitigating them. In order to monitor ecosystem responses to climate change, India's Ministry of Environment, Forests and Climate Change launched its Long Term Ecological Observatories programme, intended to monitor socio-ecological systems, at the Paris conference.

However, climate change is far from being the only, or even most immediate, stressor for the environment. Karthik Teegalapalli and Deborah Lawrence call attention to the spread of oil palm plantations in Northeast India, and Eduardo Gallo-Cajiao points the devastating role of development on coastal intertidal ecosystems, which affects many species of shorebirds amongst other animals. Needless to say, politics plays a significant role in all these policies and consequent transformation of landscapes. Mathew Mabele questions the philosophy and practice of militarization in conservation. Staying with the intertidal theme, Hari Sridhar talks to Sonia Kefi about ecological networks, and how they can improve our understanding of non-trophic and trophic relationships in complex ecosystems . Finally, Naresh Kumar reviews Eliza Kent's 'Sacred Groves and Local Gods' which examines the link between ecological values and religious beliefs in communities in southern India.

ISSN 0974-0953

Reinventing professional forestry education in dynamic governance regimes

Since the adoption of decentralised forestry in the 1980s, foresters' roles have drastically changed from traditional command and policing roles, to advisory and supporting roles. Besides, today's tropical forestry realities are highly complex and dynamic due to changing climates, increasing global interests, rapidly spreading science and technologies, and changing social systems due to globalisation, rapid urbanisation and neoliberalisation. In such a world, the need to generate professionals who are well equipped to deal with the realities is essential. But, what kind of professional capabilities do foresters require to solve complex and dynamic forest governance challenges? Joana Ameyaw and colleagues provide a starting point through a study that aimed to explore knowledge and skills needed for today's professional foresters to move towards improved forest governance in Ghana.

They explored root causes of observed and documented weak forest governance in Ghana. Informed by data collected through a mixed methods approach, they attribute a substantial part of the weakness to professional forestry education that has largely been based on forestry science and silviculture – 'traditional forestry' – since professional forestry training started in 1982. Such training largely equips forestry professionals with technical capabilities only. In the times when the forestry sector faces governance challenges such as corruption, weak structures for forest governance monitoring, elite power position of politicians over forestry, lack of staff and logistics at the Forestry Commission etc., it is necessary for professional forestry education to put more emphasis on non-technical capabilities. Their arguments are based on the finding that many professional foresters are not equipped with the non-technical knowledge and skills necessary to manage these transformations and address resulting challenges.

They identify key capabilities that would also necessitate curricula changes in professional education. They emphasise training in leadership skills that enable foresters to make and defend professional decisions against powerful elites' influence; analytical and critical reflection on forestry realities framed within the political economy approach, to help foresters in developing innovative and transformative ideas for improvement; resource mobilisation skills to deal with inadequacy in materials necessary for effecting forest governance; professional ethics for dealing with the culture of corruption, and acquiring skills for forestry diplomacy, vital to negotiate and lobby for resources required to improve governance. Besides, recognition and validation of the new skills require radical changes in incentive and reward structures within forestry institutions. These are crucial steps for professional foresters to keep pace with rapidly changing forest governance realities.

Ameyaw J, B Arts & A Wals. 2016. Challenges to responsible forest governance in Ghana and its implications for professional education. *Forest Policy and Economics*, 62: 78–87. doi:10.1016/j.forpol.2015.07.011.

Mathew Bukhi Mabele is a doctoral student at the Department of Geography, University of Zurich, Switzerland, mathewbukhi.mabele@geo.uzh.ch.

feature Karthik Teegalapalli and Deborah Lawrence

Archana Sreenivasan

Palming off the forests: social and ecological implications of introducing oil palm plantations in North-east India

Oil palm plantations are lucrative and are being actively encouraged by the Government across north-eastern India. After the first cut of forests in the region for oil palm in Mizoram, spread across over 20,000 hectares, Arunachal Pradesh State is on track to becoming a major oil palm producer in the coming years with over 100,000 hectares considered suitable for oil palm cultivation. In August last year, the State Government signed contracts with three companies to open up oil palm plantations over 20,000 hectares in the next five years. The rationale seems simple according to a report by the State Government of Mizoram; farmers currently undertaking shifting cultivation, which is perceived as wasteful and destructive, can grow oil palm and improve their own economy as well as reduce the country's dependence on imported oil palm. But several examples from South-east Asia provide evidence to suggest that oil palm plantation development is riddled with complexity. Lets first look at the ecological impacts.

EFFECTS ON LANDSCAPES

The forests in Indonesia and Malaysia, countries that produce most of the world's oil palm, have borne the brunt of oil palm expansion over the last three decades: by the year 2005, oil palm plantations in Malaysia and Indonesia affected over 30 million ha of forests. Besides directly causing deforestation leading to biodiversity loss and increased carbon emissions, oil palm plantations have collateral impacts such as soil erosion as well as air and water pollution due to mill effluents and plantation run-off.

Water quality in streams is affected by plantations: studies have shown that water from plantations was nearly 4°C warmer, sediment concentration over 500 times higher and the stream health in terms of stream metabolism was lower than forest streams. While oil palm plantations support lower biodiversity relative to other land use types such as rubber, cocoa and coffee plantations, diversity is also lower than in secondary forests formed following shifting cultivation, which involves small-scale forest clearing followed by natural regeneration.

Palm plantations also accentuate the risk of fire in landscapes; while many oil palm plantations in Indonesia are on drained peat forest rather than uplands, low tree density and lack of ground cover can contribute to a hot, dry, fire-prone environment. Industrial manipulation of the landscape for oil palm development was considered a significant factor responsible for more than half the fires that raged across Indonesia last year and affected over a million hectares of forests. George Monbiot, the environmental writer, called this "the greatest environmental disaster of the 21st century so far" .

IMPACTS ON PEOPLE

Such ecological impacts will affect the forests in the Indian North-east, which besides supporting several endangered flora and fauna are largely managed by indigenous communities. Shifting cultivation or swidden, a mountain farming system practised by about half a million families across a roughly equal area in hectares, annually, is the mainstay of the region. While on the one hand, the practice provides food security in remote mountainous areas, on the other, farming communities also draw strong links between the practice and their own cultural identity. As oil palm plantations spread and replace cultivable area under swidden, they can be expected to affect livelihoods of farming communities that subsist on the practice. For instance, palm plantations have affected the Dayak community in Central Kalimantan, Indonesia; following the establishment of plantations, communities had to travel farther to collect forest produce, to hunt and to prepare their swiddens.

Palm plantations also accentuate the risk of fire in landscapes; while many oil palm plantations in Indonesia are on drained peat forest rather than uplands, low tree density and lack of ground cover can contribute to a hot, dry, fire-prone environment.

Besides such direct impacts, other indirect social impacts have been documented from South-east Asia such as lack of transparency regarding the smallholder-plantation arrangement, bonded labour, use of non-local employees, amenities promised by companies not being made available, unsafe use of fertilizers, high rates of injury among plantation workers, corruption between officials and plantations and breakdown of traditional social structures. Further, the perceptions of economic benefits of oil palm vary across different stakeholders–local communities, corporations and governments–and this has led to conflicts between them. Several sites with oil palm plantations in South-east Asia have reported economic gains but some argue that these gains often accrue to migrant labourers rather than indigenous people.

In most parts of North-east India, settled cultivation or wet rice cultivation provides an important alternative and often supplements the activity of shifting cultivation. Irrigation comes at a premium due to the undulating terrain in the region.

Diverting this scantily available resource to water-intensive oil palm plantations could affect food security and livelihoods of farming communities. The remoteness of the area further complicates the prospects for oil palm. Several parts of North-east India are not well connected with markets and processing units. Where access is poor, product quality may suffer, since fresh oil palm bunches need to be processed within 24 hours of harvest to ensure good quality oil and to avoid build-up of free fatty acids.

SUSTAINABLE PALM OIL?

Recognizing the problems associated with oil palm plantations, the Roundtable on Sustainable Palm Oil (RSPO) was formed in 2004 to ensure environmentally sustainable and socially responsible practices and to certify companies that adhere to its principles. Certification should provide some protection for North-east India, however implementation of RSPO principles has been fraught with issues. Firstly, RSPO membership itself is problematic: 65 % of the RSPO are members that trade crude palm oil while only 20 % are oil palm growers. The majority, then, have no direct responsibility for practices on the ground. Secondly, the social, ecological and environmental expertise for effective implementation of the principles of RSPO is lacking in the countries where oil palm is grown. Further, in the year 2012, only a third of palm oil production by RSPO members was certified as sustainable.

ARE THERE ALTERNATIVES?

Given that oil palm plantations have affected both forests and communities in South-east Asia, and that the expansion of plantations in North-east India is still at its nascent stage, the time is ripe to look for alternatives. However, alternatives are not easy to come by since palm oil is widely used in edible and cosmetic products and oil palm is a highly productive crop in comparison with other oil crops such as soybean, sunflower and rapeseed.

Short-term measures involve improving productivity of existing plantations and avoiding further deforestation for future plantations. Some conservation biologists claim that boycotting oil palm is not the solution since producing oil from a different crop can affect even larger areas. Instead, making existing plantations more efficient and productive and utilizing a portion of the revenue generated from plantations to safeguard other forests has been suggested. Even the focus of the international environmental organization, Greenpeace, is to 'break the link between palm oil and deforestation rather than for palm oil to be excluded' .

Long-term alternatives are being researched with some success. In February last year, researchers at the University of Bath, England developed a way to produce the oily yeast Metschnikowia pulcherrima that has the lipid profile of palm oil. While they believe that it can likely grow on most organic feedstock and that its commercial production could be undertaken in 10 to 100 times less area than oil palm, the economically viable production of this yeast may take a few more years of research.

Irrigation options for settled cultivation in North-east India are limited due to the undulating terrain. If the irrigation water is diverted to water-intensive oil palm plantations, the food security of the farming communities will be endangered. The remoteness of the area further complicates the prospects for oil palm.

CONCLUDING REMARKS

The forests in North-east India are already vulnerable to proposed dams, timber extraction, non-traditional shifting cultivation, mining for coal and limestone and previously introduced monoculture plantations such as tea, rubber and cashew, among others. Similarly, the livelihoods of farming communities are affected by policies that discourage shifting cultivation, a practice that provides subsistence to remote mountain farming communities. Introducing another forest conversion scheme at a large scale of several thousands of hectares poses risks to the land and the people.

Learning from experiences in a similar cultural and ecological landscape in neighbouring countries in South-east Asia, it may be more practical and ecologically sound to initially undertake small-scale oil palm plantations in previously cleared sites in North-east India and expand slowly in sites with other land use types without causing further deforestation. The expansion should also be based on learning from successes and failures at initially established sites. In terms of management of oil palm plantations, companies designated to establish oil palm plantations must strictly adhere to RSPO principles, and local farmers should be involved throughout the decision making process including the actual management of the plantation to prevent negative social repercussions. Otherwise, instead of improving the economic conditions of communities in North-east India which is ostensibly an important reason for oil palm expansion, plantations may further marginalize farmers that subsist on shifting cultivation and cause extensive and irreversible ecological damage.

Acknowledgments:

The article was written during the first author's Fulbright-Nehru fellowship at the University of Virginia. He thanks the United States-India Educational Foundation for the fellowship and the authors thank Dr. Geoff Hyde for useful comments which improved the article.

References:

Fitzherbert EB, MJ Struebig, A Morel, F Danielsen, CA Brühl, PF Donald & Phalan, B. 2008. How will oil palm expansion affect biodiversity? *Trends in ecology & evolution*, 23(10), 538-545.

Gillespie P. 2011. How Does Legislation Affect Oil Palm Smallholders in the Sanggau District of Kalimantan, Indonesia? *Australasian Journal of Natural Resources Law and Policy*, 14(1), 1-37.

Koh LP & DS Wilcove. 2007. Cashing in palm oil for conservation, *Nature*, 448(7157), 993-994.

Obidzinski K, R Andriani, H Komanidin & A Andrianto. 2012. Environmental and social impacts of oil palm plantations and their implications for biofuel production in Indonesia. *Ecology and Society*, 17(1), 25.

Raman TRS. 2014. Perils of Oil Palm, 20 August 2014, *Newslink* (Aizawl).

Srinivasan U. 2014. Oil palm expansion: ecological threat to north-east India. *Economic and Political Weekly*, XLIX, Sep. 06, 2014.

Karthik Teegalapalli is a PhD candidate at the Nature Conservation Foundation, karthik@ncf-india.org.

Deborah Lawrence is a professor of environmental sciences at the University of Virginia, dl3c@virginia.edu.

Smitha Shivaswamy

Intertidal networks

an interview with Sonia Kefi

A first step in our understanding of how complex ecological systems might respond to environmental change is to know all the possible ecological links among constituent species. Research in this context, so far, has been partial to feeding interactions and paid less attention to non-trophic ones. In a first-of-its-kind study published recently in Ecology, Sonia Kefi and colleagues describe a comprehensive ecological network including all known trophic and non-trophic interactions among 100 species living in the marine intertidal areas of the Chilean coast. ***Hari Sridhar*** *spoke to* ***Sonia Kefi*** *about the origins this study, its main findings, and its implications for our understanding of the resilience of complex systems.*

Hari Sridhar: In your paper, you say that most of the work on ecological networks so far has focussed on one single interaction at a time, i.e. food, mutualistic interactions like plant-pollinators and plant dispersers, and host-parasite interactions. You make the point that non-trophic interactions, especially positive ones, haven't received as much attention in network approaches to understanding ecological communities. Why do you think this is the case? Is it because of the difficulty of identifying them in the field or have there been analytical challenges?

Sonia Kefi: It is probably a combination of all of that. For long, there was a bias in studying negative interactions – particularly predator-prey and competitive interactions. To some extent that makes sense, but it is also based on a certain conception of nature, the idea that those processes are the ones that structure ecological communities, the ones that we need to understand. In addition, like you say, a lot of non-trophic interactions are non-trivial to measure. Trophic interactions can often be observed – an individual eats or does not eat other individuals – but a lot of non-trophic interactions are not directly observable and require experiments. On the more theoretical side, people have built simple models (small communities) incorporating trophic and non-trophic interactions, but complex networks are often built on a single interaction type.

HS: Is this study a first of its kind – a unipartite network which includes trophic and, positive and negative, non-trophic interactions? Are there any other examples of that?

SK: Very recently, a paper from Sander, Wootton and Allesina used a similar dataset from Tatoosh Island, although this network seems to have fewer non-trophic interactions. The other work that is along the same lines is the paper from Michael Pocock (Jane Memmott's group), published in Science in 2012. It's based on a different approach merging several bipartite networks (plant-pollinator, plant- disperser, host-parasite, plant-herbivore and so on). For a unipartite network, I think that the Chilean web is quite unique for now, but such data sets are probably going to become more frequent in ecology

HS: And what made this possible for you is the availability of this huge dataset from Chile, right?

SK: Yes, intertidal communities have been studied

very well from the point of view of non-trophic interactions for decades, and also in an experimental way.

HS: You mean this particular intertidal community or in general?

SK: There is a long tradition of natural history and manipulative experiments in intertidal communities in general. Sergio Navarrete and Evie Wieters have done immense work in that area, but many others as well such as the teams of Robert Paine, Mark Bertness or Bruce Menge for example. I am not sure about why this tradition is there in intertidal communities. Maybe because some non-trophic interactions are particularly obvious there – e.g. refuge provisioning, competition for space, recruitment facilitation. This is why those communities are such a great opportunity to incorporate all that knowledge in a network context along with trophic interactions.

HS: I would like to talk a little more on how this collaboration came about – between you and the team in Chile. Can you tell us about the history of this project?

SK: My PhD focussed on drylands – I was working on models of vegetation dynamics. The idea was to investigate how catastrophic shifts emerge in these ecosystems. Toward the end of my PhD, it seemed natural to wonder what would happen if plants were not treated as one whole component (as classically done in models of dryland vegetation dynamics) but instead as individual species with different characteristics. The question is then how taking this plant diversity into account affects the ecosystem dynamics, its resilience and the behaviour of the indicators. This was how I started thinking about food webs and networks and how I became familiar with the body of ecological theory looking at species diversity and coexistence. I applied for a postdoc with Ulrich Brose in Germany who is a specialist of food web dynamics. My postdoc project was about studying resilience of complex ecological networks with different interactions types between species. I realised quickly that I had no idea where to introduce non-trophic links in such complex networks. The possibilities were immense. I had no idea even how frequent those interactions were. Around that time, Eric Berlow and Carol Blanchette organized a workshop in California with Sergio Navarrete, Evie Wieters, Bruce Menge, Lucas Joppa, Spencer Wood and others. I went to that workshop and that's where the idea of building the Chilean web came up.

HS: Over what period of time was the data that went into the paper collected?

SK: They did not collect field data specifically for that paper but they used their own expert knowledge of years of observation and experimentation along the central coast of Chile. They also dug into the rich literature about these communities to compile the data set. Sergio and Evie started working on the data set at the workshop in 2009, and I think that we had a first version of the ecological network in 2010.

HS: How long did it take from idea to publication? When did the workshop happen?

SK: The workshop took place in 2009, the Ecology Letters paper came out in 2012 and the Ecology paper in 2015.

HS: Did the authors meet as a group often?

SK: The first meeting was at the workshop in Yosemite in 2009. After that, from 2011, I have been going to Chile once a year to meet with Sergio, Evie and Eric. But, basically, most of our discussions were over email.

HS: Can you give us a simple step-by-step breakup of the process of going from data in the field to the final published network?

It was quite natural to wonder what would happen if plants were not treated as one whole component but instead as individual species separately - some might modify the environment and others might not. The idea is to build models where plants are not considered as one big chunk of biotic things that modify the environment but incorporate each plant species with its individual traits.

SK: Before even thinking of the data, there was enormous discussion about what type of information we needed in what format. There was then discussions with experts, going through the literature and gathering everything that's known about every pairwise interaction of species in the dataset. There was a lot of work in making the dataset "clean" categorising every interaction as "certain" or "uncertain". For example, maybe we found only one paper on a particular pairwise interaction which means that there is a question mark over that particular pair. Then, once the dataset was ready, there was the question of the analyses. We decided to focus on three 'layers' - the trophic interactions on the one hand, the non-trophic interactions on the other hand, and within non-trophic interactions whether the interactions were positive or negative. So, we split the network into three networks that we thought were most relevant for the analysis and later for incorporation into ecological theory. When we started doing statistics on the network, we went back to the field experts, to get a feel of whether the patterns emerging made sense, whether they corresponded to their intuition based on field experience. Little by little, we identified some mistakes - species that were misidentified or interactions that were mislabelled – and corrected them.

HS: What are the main take-homes from this study?

SK: It was surprising that all those non-trophic interactions were a lot more frequent than we had assumed. In the Chilean web, there are actually two times more non-trophic than trophic interactions. Moreover, they are structured – their structure is not random relative to the trophic interactions. So, we need to start investigating whether they matter for community dynamics and resilience and how. Can we identify key interactions and key structures in these networks that matter for the functioning of ecological systems? Collecting this kind of information is very time consuming, so the message is not that we should all start collecting all those different types of interactions everywhere, but rather that we should start investigating the possible consequences of the presence of this variety of

My original interest was trying to understand emergent phenomena and responses of complex systems to perturbations - what determines the ability of a system to absorb a perturbation and to come back to an initial state or not.

interactions and their interplay. Mathematical models might help addressing those questions, especially now that some data sets start being available that can help constrain the structure of the modelled interactions networks.

HS: You say that modularity and nestedness are important characteristics of a network from the point of view of stability. Can you tell us why?

SK: There has been quite a lot of work on mutualistic networks that have shown that certain types of structures, like nestedness - for example, that more specialist pollinators tend to pollinate a subset of plant species pollinated by generalists – stabilize mutualistic networks, i.e. it makes them less vulnerable to breakdown when species are lost. For antagonistic networks, especially food webs, researchers have shown that a modular structure, where you have groups of species that are more connected with each other than with the rest of the web - is very stabilizing. The idea is that perturbations tend to remain within the modules or compartments. That's why in our network we wanted to know whether we observe such structures, especially whether the trophic network is more modular than expected and whether the facilitative network is more nested than expected. We found some evidence of both modularity and nestedness in the Chilean web.

HS: In general, what would you say are the implications of this study for our understanding of how complex systems respond to external changes?

SK: We really need to go on with the next step, which is modelling such complex networks. This work has given us some hints about how to model such complex systems – where to put the non-trophic interactions, how abundant they are compared to trophic interactions etc. Based on this, we can integrate non-trophic interactions in a more realistic way into food web models and examine how they affect the stability of ecological networks to external perturbations. Right now I am unable to say more, except that we are in the process of building such models.

HS: Stepping away from this piece of work, I find a common theme underlies all the different research projects you lead – trying to understand how resilient ecological systems are to change. Is that coincidental or a conscious choice?

SK: Ecological resilience was my initial interest and probably one of the reasons why I went to ecology, particularly theoretical ecology. As a student, I was fascinated by work on the non-linear behaviour of ecosystems. I really liked mathematics and I thought that theoretical ecology would be such a nice combination of interesting mathematical questions with possible concrete applications. My original interest was trying to understand emergent phenomena and responses of complex systems to perturbations - what determines the ability of a system to absorb a perturbation and to come back to an initial state or not.

HS: Can you tell us how you got into ecology – are you a mathematician by training?

SK: No. There is this undergraduate option in France in which I had one-third biology, one-third physics and one-third maths for two years (so-called 'classes préparatoires'). I then passed a national exam and went into an engineering school - Agro Paris Tech - where you basically pick what you want to study (in the broad field of engineering and life sciences). It's more oriented toward life sciences but with a lot of math and computer science. In the last year of that school, I did a master in ecology at Ecole Normale Supérieure, Paris.

HS: At the undergrad. level did you already know you wanted to do ecology?

SK: When I finished high school I really wanted to do maths but I had a hard time projecting what I would do for a job if I studied pure maths. I wanted to work on questions that might have an application not too far off into the future. This is how I discovered theoretical ecology, and I thought this is what I want to do - use maths to model ecosystems.

HS: You say that you were interested in maths but wanted to do something that had an application. Is conservation and management of natural resources always at the back of your mind when you choose your research projects?

SK: There is a double motivation. I am very interested in the fundamental understanding of these complex systems. My belief is that if we understand those mechanisms well enough, we have a chance of creating tools that might be useful for their management. The degradation indicators I am now working on have to be further developed before that can be used for management - we are still at an early stage, trying to figure out in which

My belief is that if we understand the fundamental mechanisms of these complex systems well enough, we have a chance of creating tools that might be useful for management.

cases they are expected to work and how robust they are. My hope is that whenever we are more confident about the degradation indicators, they can be picked up by managers and be actually used in the field. This is one of the objectives of the European project CASCADE, which I am part of.

References

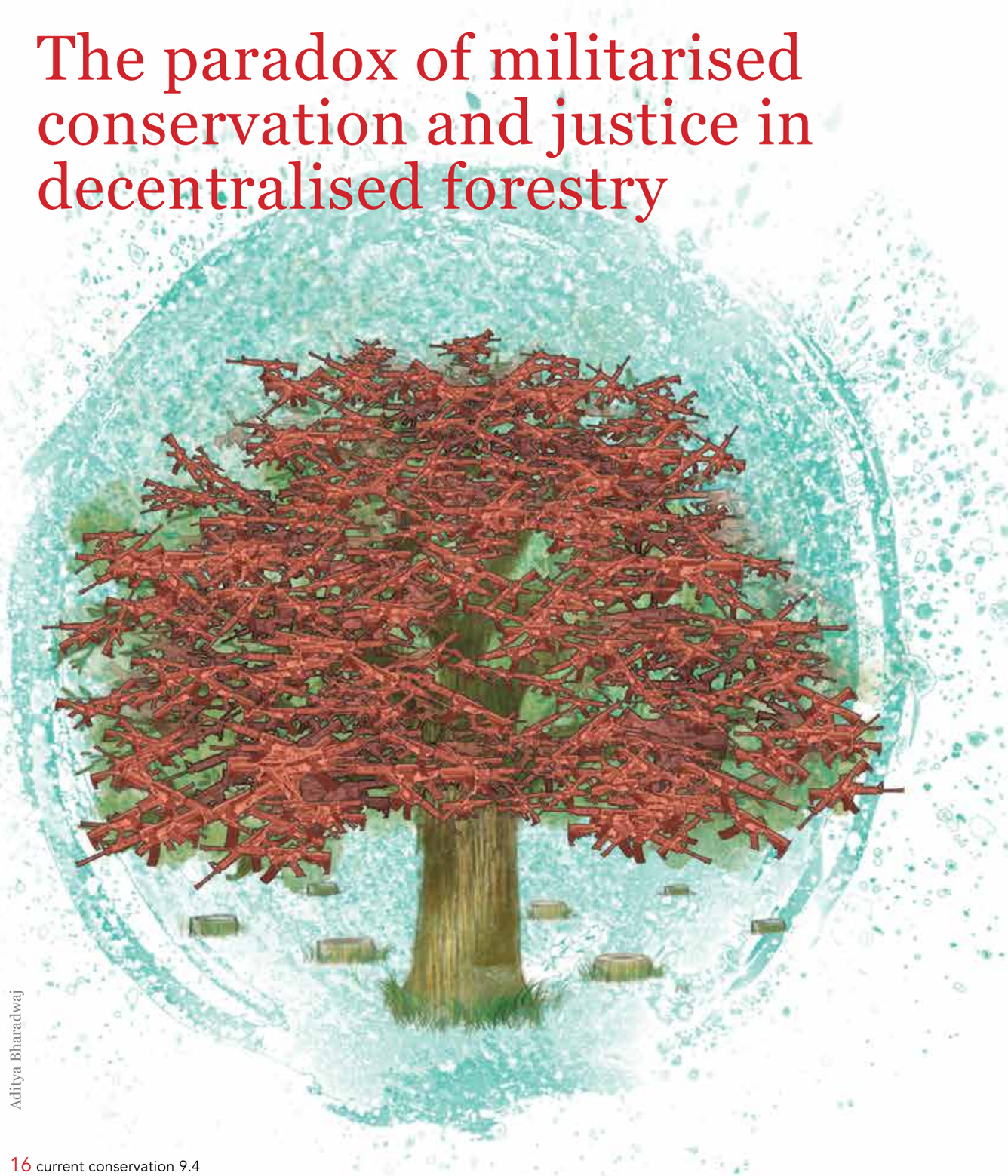
Kéfi S, EL Berlow, EA Wieters, LN Joppa, SA Wood, U Brose & SA Navarrete. 2015. Network structure beyond food webs: mapping non-trophic and trophic interactions on Chilean rocky shores. *Ecology,* 96(1), 291-303.

Pocock MJ, DM Evans & J Memmott. 2012. The robustness and restoration of a network of ecological networks. *Science*, 335(6071), 973-977.

Sander EL, JT Wootton & S Allesina. 2015. What can interaction webs tell us about species roles?. *PLoS Comput Biol*, 11(7), e1004330.

Hari Sridhar is a postdoctoral fellow at Indian Institute of Science, Bangalore, harisridhar1982@gmail.com.

The paradox of militarised conservation and justice in decentralised forestry



Aditya Bharadwaj

I have recently observed a growing trend of illegal resource utilisation that is countered with armed responses across East Africa's protected areas. Various local and international media link illegal logging with devastation and extinction of tree species and forests. A recent UNEP and INTERPOL report, titled 'The Environmental Crime Crisis', sees illegal logging and associated crimes as threats to human well-being and the broad sustainability agenda. It is especially interesting to note how governments and conservation organisations have responded. There are both news articles and academic discussions documenting an emphasised use of military and paramilitary tactics against illegal resource utilisation. The tactics' advocates claim that as illegal resource extraction is becoming more sophisticated, armed and well organised, the use of militarised counter-measures is necessary. To show how seriously they are, in June 2014, high-level government representatives from Kenya, Tanzania and Uganda announced their intention to curb armed illegal logging with the help of the INTERPOL through the East Africa Initiative on Illegal Timber Trade and REDD+. Likewise, in a recent budget speech, one heard the minister of natural resources and tourism in Tanzania proudly talking about the ministry's plan to involve the Tanzania Police Force in controlling illegal logging. In the recent final evaluation report of REDD+ pilot projects in Tanzania, there was a recommendation about military training for local forest rangers to enable their 'self-defence' against armed and aggressive illegal loggers when carrying out forest patrols and monitoring.

As a political ecology researcher, I see the trend and resulting counter-measures as interesting 'case studies' to scrutinise the emerging and intensifying dynamics about violence, conflicts, justice and struggles over natural resource utilisation and conservation. Rosaleen Duffy and Elizabeth Lunstrum have referred to the use of military and paramilitary tactics – actors, techniques, technologies and partnerships – in the pursuit of conservation as 'militarised conservation' and 'green militarisation' respectively. Though 'militarised conservation' is not new (it was practiced during the fortress conservation regimes in colonial and early postcolonial era), it is the intensification in terms of actors, techniques and technologies involved, its ill understood justifications (ethically and morally) and consequences towards justice that seem to capture interests of political ecology researchers (including myself). For instance, in his recent inaugural professorial lecture, Bram Büscher has called the intensification of violence, conflicts, securitisation and surveillance in natural resource utilisation as one of the 21st century 'development and change' problematics that need further scrutiny. There is also an upcoming panel, titled Conservation and/as unending war in sub-Saharan Africa of the Political ecologies of conflict, capitalism and contestation conference at Wageningen University. The panel intends to foster critical discussions for understanding the logics and dynamics behind the surging militarisation and war-making in the conservation frontiers of sub-Saharan Africa.

My interests on the topic are centred on questioning moral and ethical justifications [in connection to local forest justice] for using armed responses to counter illegal resource utilisations in the defence of non-human species.

My interests on the topic are centred on questioning moral and ethical justifications (in connection to local forest justice) for using armed responses to counter illegal resource utilisation in defence of non-human species. Roderick Neumann's article on moral and discursive geographies, and Rosaleen Duffy and colleagues' recent back-to-back articles on the nuances of understanding the links between poverty, illegal wildlife hunting and intensified militarised conservation influence my thinking and the arguments I raise in this piece. The idea

of shooting or even attempting to shoot a person in the defence of non-human species is seemingly absurd, especially when motivations that drive the person into illegal resource extraction are currently either ill understood or wrongly conceptualised. People may illegally extract forest resources as a response to increased demand for certain high-value timber from wealthy populations in the country and abroad; as a form of revenge against increased crop raids and livestock predation as a result of improved forest cover; as a mechanism to cope against restricted forest access (due to decentralised governance regimes) that precludes pre-existing income generating activities etc.

Here, I therefore conceptualise 'militarised conservation' as a paradoxical approach in three ways: first, the approach does not differentiate subsistence and commercial illegal resource utilisation i.e. it applies similar tactics when countering illegal resource extraction by individuals for subsistence and survival, and by well-organised groups for large-scale profit making. Secondly, the approach focuses attention only in tackling one end of the illegal resource extraction chain, ignoring the political economic contexts (at national and international levels) that drive illegal extraction at the local scale, thus creating furthering injustices. Lastly, advocates for 'militarised conservation' see the approach as justifiable in the defence of non-human species, but it does not allow 'spaces of exception' in cases where people responsible for forest protection under decentralised regimes fail – due to structural or relational reasons – to fulfil their responsibilities. I use my experience as a political ecology researcher in Tanzania to reflect on the three aforementioned ideas in connection with militarised conservation and justice.

I developed an interest in militarised conservation and justice implications during my fieldwork and research activities as a Masters student at the University of Dar es Salaam, Tanzania. I spent six weeks carrying out fieldwork (between April and May 2010) in three villages, studying the political ecology of a decentralised forestry scheme in northern Tanzania. I explored influences of power struggles and relations over forest costs and benefit sharing amongst participating actors in Nou Forest Reserve (NFR). Though it was not the initial focus of my research, I often heard discussions about surging armed illegal timber extraction. In several formal and informal discussions, villagers told me about how 'clever' illegal forest users had become as a result of using better weaponry than the local forest rangers possessed (sticks and machetes). The Joint Management Agreement (JMA) requires rangers to accompany the Village Natural Resource Committees (VNRCs) three times per month to undertake forest patrols and monitoring as part of the villagers' responsibilities in the scheme. Failure to fulfil such responsibilities could put the scheme into an impasse without the villagers' consent. Therefore, for the villagers to maintain their 'distributive justice' i.e. abilities to derive benefits (mostly through harvesting non-timber forest products, confiscating illegally harvested logs/timber and collecting fines from caught offenders) from the scheme, it was mandatory to perform forest protection duties effectively.

The lack of advanced weaponry to counter the armed illegal loggers' tactics meant that participating villages were to be seen as irresponsible partners thus being axed from the joint forestry scheme. To avoid that and keep the flow of the benefits, the villages asked the Babati district police force to provide support in terms of personnel and equipment during forest patrols. With limited budgets, the police help did not last long as the villages lacked sustainable funds to cover fuel costs of the police vehicles and per diems of the patrol team members. Unfortunately, the police involvement led to a change of tactics by illegal loggers who started doing their activities at night. With just sticks and machetes and without heavy-duty night-time lightning equipment, the local patrol teams did not dare put themselves into a grave danger by carrying out night-time patrols. Thereafter, the patrols became very irregular as perceived security risks and lack of allowances discouraged local forest patrolling. This meant that the villages would potentially be cut off from the scheme, thus going back to a governance regime where the state (through the forestry department) would oversee forestry under commanding and policing means, which have historically produced long-lasting injustices to forest-dependent people.

The lack of advanced weaponry to counter the armed illegal loggers' tactics meant that participating villages were to be seen as irresponsible partners and were thus being axed from the joint forestry. To avoid that and keep the flow of the benefits, the villages asked the Babati district police force to provide support in terms of personnel and equipment during forest patrols.

Other parts of Tanzania are also experiencing this paradoxical militarised conservation, which has produced or enforced injustices. Cases of illegal logging syndicates made headlines in 2007 as top public officials were involved in illegal extraction in southern Tanzania and trade in high-value timber to China and India (where there is increased demand for such timber). Interestingly, in the crackdown that followed, it was the local people (involved as log cutters, timber makers and transporters) who bore the negative consequences, while powerful people behind the illegal logging avoided the consequences of forceful countermeasures.

In general, I suggest that the use of armed counter-response against illegal resource utilisation indicates a weakness, as illegal activities may contain the hidden message that people are not satisfied with existing governance regimes and the promises they offer. Or they find the regimes and promises inefficient, damaging, or simply irrelevant with regard to local contexts. Likewise, 'militarised conservation' reveals the widening gap between policy and practice, indicating how policies are not in harmony with realities on the ground. So policy proponents have to use greater force when the policies falter in the face of local realities. And this usually does not end well for locals, as recent cases in Pugu-Kazimzumbwi forest reserves show. Here, with an eviction order signed by the Prime Minister, a local conservation NGO financed the Tanzania Police Force to forcefully evict people who were classified as 'forest encroachers' by the forestry department and the NGO, but as legal occupiers by the Ministry of Land. Most of the evicted people were farmers and pastoralists who occupied the forestland for subsistence (and a small percentage through charcoal production). This happened at a time when economically and politically powerful individuals in Dar es Salaam were hiring some of the evicted people as their servants in the lucrative charcoal making business. As always, it was local people who faced the consequences of the police force as policemen confiscated their property such as bicycles, harassed them and handed unfair judicial treatments to the 'local offenders'.

With this piece, I raise two related arguments. Firstly, unless the driving forces for people to engage in illegal resource extraction are well understood and conceptualised within academic and policy spheres, militarised conservation or green militarisation will remain a paradoxical approach. One of the possible ways to enhance our understanding and conceptualisation is by looking at the motivations from a political economy lens; and policy makers must use these analyses in policy development. In a country such as Tanzania where GDP growth has been at 7% over the past ten years, but poverty is still widespread, illegal resource extraction (especially by those doing it for subsistence) may be conceptualised as an outcome of distributive injustice as a result of unequally distributed national wealth and other related political economic processes. It is such

situations where natural resources-dependent people entangled in the broad and complex political-economic processes that leave them without 'rational' options, may be involved in illegal resource utilisations.

Therefore, as long as 'militarised conservation' does not acknowledge how and why people are motivated to engage in illegal resource extraction, it will be remain an approach that may further injustice. In such times of crisis (as illegal extraction surges due to local 'military' incapacities), normal law and regulations about forest protection responsibilities and consequences of failing to fulfil them should not hold, as enforcing them will only increase injustice. 'Militarising' local forest rangers can only escalate conflicts between local rangers and illegal resource users, which will raise further questions about moral and ethical justifications of any killing of humans in defence of nature, and even local forest justice. I argue therefore that it is necessary to have such 'spaces of exception' as better temporary solutions while working to redress the political economic processes that motivate people to engage in illegal resource utilisation, thereby reducing injustice and creating long-term equitable solutions.

Further reading

Cavanagh C, PO Vedeld & LT Trædal. 2015. Securitizing REDD+ Problematizing the emerging illegal timber trade and forest carbon interface in East Africa. *Geoforum* 60: 72 – 82.

Duffy R. 2014. Waging a war to save biodiversity: The rise of militarized conservation. *International Affairs* 90(4): 819–834.

Duffy R, FAV St John, B Büscher & D Brockington. 2015. Toward a new understanding of the links between poverty and illegal hunting. *Conservation Biology*.

Lunstrum E. 2014. Green militarization: Anti-poaching efforts and the spatial contours of Kruger national park. *Annals of the Association of American Geographers* 104(4): 816–832.

Neumann R. 2004. Moral and discursive geographies in the war for biodiversity in Africa. *Political Geography* 23: 813–837.

Mathew Bukhi Mabele is a doctoral student at the Department of Geography, University of Zurich, Switzerland, mathewbukhi.mabele@geo.uzh.ch.

Muddy Business in the Yellow Sea

Shorebirds complete some of the most incredible migrations, but their conservation is at a crossroads in a region where coastal management is highly contested.

INTRODUCTION

Looking out the window from the plane as I approach Incheon international airport, which serves Seoul, the views of coastal reclamation become evident before my eyes, straight coastlines where cranes are erecting high rise buildings in newly created land. These very places used to be visited by many waterbirds not long ago. South Korea became one of the four Asian tigers, maintaining exceptional economic growth rates between the 1960s and the 1990s. Not surprisingly, this country is currently one of the richest in the world. However, some of the areas that have become icons of its economic development are also important for many species, whose survival is now dwindling. Here, I present an account that brings together a group of fascinating waterbirds, migratory shorebirds, and the politics of coastal reclamation in a region critically important for them.

WHAT ARE MIGRATORY SHOREBIRDS?

Shorebirds are amongst the ultimate globetrotters. Many of these birds are typically associated with wetlands, either inland or along coastlines. Taxonomically, they comprise over 200 species within the order Charadriiformes, which includes many familiar species such as lapwings. These birds convey an incredible story of endurance, almost unimaginable. Many of them breed at high latitudes in the northern hemisphere in the boreal and tundra regions across the entire world. These places experience inclement winters, but during summer a surfeit of sunlight and milder temperatures provide shorebirds with a surge of feeding opportunities during their breeding season. As summer finishes, these birds begin their non-breeding season migrating to lower latitudes closer to the equator and even to high latitudes in the southern hemisphere across South America,

Eugene Cheah

Africa, Asia, and Australasia. Then, the shorebirds fly back to their breeding grounds once the northern hemisphere summer has returned. This cycle is thus repeated yearly.

But how can shorebirds migrate such long distances? The key seems to be in physiological and behavioural traits. Prior to migration, these birds feed voraciously resulting in an excess of calorie intake that is deposited subcutaneously as fat, which fuels their constant flapping during their long journeys. Additionally, they tend to fly using tailwinds, as opposed to headwinds, hence reducing energy expenditure and flight time. Other adaptations include an increase in flight muscles and a reduction of digestive functions, such as stomach atrophy. However, the maximum single flights these birds can undertake are generally not enough to cover the entire distance between their breeding and non-breeding grounds and vice versa. Therefore, shorebirds must stop to rest and refuel along the way at so-called stopover sites.

How can shorebirds migrate such long distances? The key seems to be in physiological and behavioural traits. The maximum single flights these birds can undertake are generally not enough to cover the entire distance between their breeding and non-breeding grounds and vice versa. Therefore, shorebirds must stop to rest and refuel along the way at so-called stopover sites.

One of the main coastal habitats used by these species outside their breeding season is intertidal mudflats, so the occurrence of these sites constrains where shorebirds live and how they migrate. These places provide them with a plethora of marine invertebrates that live on or in the mud, which shorebirds predate upon at low tide, when mudflats get exposed. Nonetheless, mudflats are not a pervasive feature of the world's coasts. They are patchily distributed as they are formed in regions where a combination of factors must converge, such as high deposition of sediments usually discharged by large river systems, gentle slopes, and embayments where fine particles settle. Hence, the migratory paths of different shorebird species, occurring in different places during their non-breeding season, are funnelled through comparatively small regions where mudflats are available, constituting critical stopover sites for birds on migration. That is the case of Delaware and Chesapeake Bays in North America, the Wadden Sea in Europe, and the Yellow Sea in East Asia. The latter is the focus of this story.

THE YELLOW SEA IN THE SPOTLIGHT

The Yellow Sea is a bottleneck for the migration of many species of shorebirds in the East Asian-Australasian Flyway. This sea, located in East Asia between China and the Korean peninsula, presents vast mudflats fed by large waterways discharging sediments, such as the Yangtze, Geum, Han, and Yellow Rivers. In the case of the Asia-Pacific, the East Asian-Australasian Flyway includes 22 countries through which over 50 shorebird species migrate. Their breeding grounds include mostly Siberia and Alaska, and their non-breeding grounds Southeast Asia, Australia, and New Zealand. In between their breeding and non-breeding grounds, are two very important stopover regions where birds rest and refuel during their migrations — the Yellow Sea and Japan. A flyway could be generally understood as a region that encompasses the whole migratory range of multiple bird species for which a common approach to their conservation is in place.

But the same factors which make shorebirds flock en masse to the Yellow Sea has also created an opportunity for land expansion. Gentle slopes along the coastlines of this region have facilitated the creation of land by filling, or enclosing, intertidal mudflats. This process is known as coastal reclamation, and has been practiced for decades by different countries around the world, such as the Netherlands. However, this has been practiced more recently at a large scale in the Yellow Sea, specifically in South Korea and China. A recent assessment of this sea's intertidal mudflats has revealed a 65% decrease since the 1950s, when they were estimated to cover 1.1 million hectares of the coastline. Traditionally, these newly created lands were primarily used for agriculture, but more recently there has been a shift towards their use as precincts for industrial complexes, housing, and transportation infrastructure, such as ports and airports. Thus, many of the places where shorebirds used to stop in large numbers during their migrations are no longer available to them.

While much attention has been devoted to the loss of other ecosystems, such as rainforests, the consequences of reclaiming intertidal mudflats are no different. In all cases, the loss and degradation of ecosystems results in declines of biodiversity and important functions. Intertidal mudflats provide habitat to a wide diversity of species. These habitats additionally protect coastal areas from storm surges and provide fishery resources, such as shellfish, to local people. As shorebirds get funnelled through the Yellow Sea during their migration, coastal reclamation in this region has a disproportionate effect on their flyway populations. Studies conducted at different sites within the East Asian-Australasian Flyway have revealed abundance declines of migratory shorebirds, many of which rely on the Yellow Sea. These trends are likely to be reflecting flyway-wide population declines. Consequently, five of the species occurring in this flyway have been listed as threatened by the International Union for Conservation of Nature.

THE SAEMANGEUM CASE

The drivers of coastal reclamation in the Yellow Sea have been complex and involve the interaction of multiple factors. In recent times, the case has been fuelled in China by GDP growth targets set for local governments by the central government. By contrast, the reclamation of intertidal mudflats has been intertwined with political discourses of economic development in South Korea. Additionally, rice has been one of the staples in this country, and with 70% of its land being mountainous, there has traditionally been pressure to expand agricultural land. Since the 1960s, this country had a strong policy to increase national rice production as its yield was then insufficient to meet internal demand. As a result of this policy, the country reached sufficiency in the mid 1970s, which was also a consequence of decreased demand as South Koreans' diets became more diversified.

The process of coastal reclamation in the Yellow Sea has comprised multiple projects; nevertheless there is little doubt that Saemangeum, in South Korea, has been by far the most prominent. This

Nicholas Murray

The Curlew Sandpiper (*Calidris ferruginea*) is a shorebird species that relies heavily on the Yellow Sea during its migration

project, led by the Ministry of Agriculture and Forestry, is considered to have triggered the rise of environmentalism in this country. Saemangeum is the estuary of the Mangyeung and Dongjin Rivers close to Gunsan City, 180 km south of Seoul, on the Yellow Sea coast. This area was selected for reclamation as a commitment made by President Roh Tae-woo during his campaign in 1987, but the site had initially been identified since 1971 as part of a national plan for modernisation of the rural economy. The project officially commenced in 1991 and saw the final completion of a 33 km seawall in 2006, enclosing an area of 40,100 ha, of which 28,300 ha would be new land.

The consequences of Saemangeum for migratory shorebirds were considerable. With the seawall completed, tidal flow was stopped, so mudflats were now either permanently underwater or permanently exposed. This outcome meant shorebirds could no longer access food resources. The submerged mudflats were now out of reach, while the exposed mudflats became devoid of marine invertebrates important for shorebirds, such as bivalves, because they perish in the absence of regular flooding. This estuary was one of the most important sites for migratory shorebirds in South Korea, as it used to provide stopover habitat for up to half a million shorebirds during their northern and southern migrations each year.

The reclamation of Saemangeum had a turbulent history prompted by a previous environmental disaster. Despite little opposition in the horizon when initially proposed, there was a precedent that sparked environmental activism in an attempt to avert the debacle. Just a few years after this project had commenced, a similar project, known as Shiwha Lake, was being completed with unintended consequences. An estuary where six rivers flow, 35 km west of Seoul, had been enclosed by the construction of a dyke, a project conducted between 1987 and 1994. The purpose of this scheme was to create a freshwater lake for agricultural irrigation, as well as to accrue land for urban and industrial development. As a consequence of land-based pollution, primarily from factories established in the newly created land, the water from the lake became unsuitable for irrigation. Furthermore, any plan to remove the dyke was

Micha V Jackson

The Bar-tailed Godwit (*Limosa lapponica*) is a shorebird species that relies heavily on the Yellow Sea during its migration

With the seawall completed tidal flow was stopped, so mudflats were now either permanently underwater or permanently exposed. This outcome meant shorebirds could no longer access food resources. The submerged mudflats were now out of reach, whilst the exposed mudflats became devoid of marine invertebrates important for shorebirds, such as bivalves, because they perish in the absence of regular flooding.

hampered by the presence of new constructions in low lying areas that would inevitably get flooded. Hence, the Shiwha Lake project rang alarm bells amongst NGOs and civil society about the potential consequences of allowing Saemangeum to proceed.

A disparity of values and powers set the scene for a battle amongst multiple stakeholders over the construction of Saemangeum. The initial purpose for the new land was principally rice production, but an expectation of potential industrial development similar to Shiwha Lake created support amongst some of the local people. This estuary is located in North Jeolla Province, a region quite far from Seoul and one of the least industrialised regions of South Korea. Hence the project gained the support of the Ministry of Agriculture and Forestry, the government of Gunsan City, and some local people as well. On the flip side, NGOs, scientists, religious groups, and some local residents raised their voice against it, particularly as the consequences of Shiwha Lake became evident. Additionally, opposition came from the international sphere. For instance, the Ramsar convention on wetlands leveraged views in favour of protecting this site, as did international NGOs, such as Greenpeace and Wetlands International. Concerns ranged from biodiversity conservation, including shorebirds, to potential pollution and loss of livelihoods for local fishermen.

The dispute was taken to court, but the final outcome was almost inevitable given the political nature of the proposal. The construction of Saemangeum was stalled for one year in 1999 amid the intensification of disputes between stakeholders, but eventually resume after a feasibility study and an Environmental Impact Assessment. As a response to this outcome, a lawsuit was initiated by NGOs and some of the local people opposing the project, who sued the then minister of Agriculture and Forestry to relinquish the completion of Saemangeum. Even though the verdict was at first seemingly in favour of conservation, the defendant appealed the case to the high court, whose final, and ostensibly irrevocable, decision was to allow the project. More recently, the plan for the area has shifted from primarily rice production to chiefly urban, industrial, and infrastructure development. In the mean time, the promise of economic prosperity for the region by destroying this wetland has yet to be fulfilled.

Micha V Jackson

Jen Dixon

The East Asian-Australasian Flyway defines the region through which migratory waterbirds complete their life cycle in the Asia-Pacific

WHEN HISTORY TWISTS

Just north of Saemangeum is the Geum estuary, the mouth of one of the most important rivers in South Korea, the Geum River, and a tremendously significant site for migratory shorebirds. This estuary had also been selected by the central government to be reclaimed as part of a model underpinning economic development. In a twist, the central government withdrew its plans to reclaim it in 2007, but this decision would require a negotiation with Seocheon, the local government area in question. After all, Saemangeum had promised to deliver economic benefits to the neighbouring city of Gunsan and the Seocheon local government was asking the central government for a similar plan to bring economic benefits to the region.

The central government swapped reclamation for research and education in this instance. Part of the alternative provided to Seocheon City included two government-affiliated research centres, the National Institute of Ecology and the National Marine Biodiversity Institute. The former opened in 2013, and the latter in 2015. These two institutions have research and education mandates. For instance, the National Institute of Ecology includes state of the art research facilities and an exhibition building containing an impressive collection of plants and live animals. Importantly, one of the goals of these institutes is also to draw tourism to the region, hopefully boosting the local economy. So far, the target of number of visitors to the National Institute of Ecology has surpassed expectations. The establishment of these two institutes has also created a favourable setting for rolling out additional conservation initiatives. For instance, a Memorandum of Understanding on the conservation of the Geum estuary was recently signed by BirdLife International and the Seocheon local government.

Beyond the local, there is a range of institutional arrangements in the Asia-Pacific with relevance to the conservation of intertidal habitats in the Yellow Sea. Some of these include bilateral migratory bird agreements signed by China and South Korea with counterparts including Japan, Russia, and Australia. There are additional agreements, such as the Ramsar Convention on Wetlands, the Convention on Biological Diversity, and less formal ones, such as the East Asian-Australasian Flyway Partnership and a Memorandum of Understanding on migratory waterbirds signed by WWF and China's State Forestry Administration.

FINAL REMARKS

While they may sound attractive, what do the brand new research institutes in Seocheon really mean for conserving the Geum estuary? Likewise, what can all the above mentioned institutional arrangements achieve to better manage coastal ecosystems in the Yellow Sea at large? Answering these questions is challenging. Commitments made by governments to conserve intertidal mudflats compete with other national interests that often seem to take priority. Reclamation has not been completely stopped either in South Korea or China. Nevertheless, at least the Geum estuary continues to have intertidal mudflats free from reclamation. Amid constant pressure for economic development in important shorebird areas, only time will tell whether actions by governments are sufficient to conserve the Geum estuary and many other sites they have pledged to protect.

Further reading:

Murray NJ, RS Clemens, SR Phinn, HP Possingham, & RA Fuller. 2014. Tracking the rapid loss of tidal wetlands in the Yellow Sea. *Frontiers in Ecology and the Environment*, 12, 267-272.

Wilson HB, BE Kendall, RA Fuller, DA Milton, & HP Posingham. 2011. Analyzing variability and the rate of decline of migratory shorebirds in Moreton Bay, Australia. *Conservation Biology*, 25, 758-766.

Gallo-Cajiao E & RA Fuller. 2015. A milestone for migratory waterbird conservation in Asia-Pacific. Oryx, 49, 393-394.

Choi, YR. 2014. Modernization, development and underdevelopment: reclamation of Korean tidal flats, 1950s-2000s. *Ocean and Coastal Management*, 102, 426-436.

This manuscript is additionally based on ongoing research conducted by the author and the lab he belongs to. For further information go to: www.fullerlab.org

Eduardo Gallo-Cajiao is a PhD candidate at the Centre of Excellence for Environmental Decisions at the University of Queensland, Australia. His research examines the global environmental governance for conserving migratory shorebirds with a focus in the Asia-Pacific, e.gallocajiao@uq.edu.au.

Climate change and conservation

Megha Vishwanath

12th April, 1961 – Yuri Gagarin becomes the first person to enter outer space, completing one orbit before returning safely to Earth, 1 hour 48 minutes after launch.

15th December, 2015 – the Soyuz Rocket is, at the time of writing, the latest space flight to launch from Earth, transporting astronauts to the International Space Station for a six month mission.

Today – More than 200 miles above Earth's surface, the International Space Station is in orbit. You are aboard. Travelling at 17,500 miles an hour, you complete an orbit of the Earth every hour. Watching out of the window, your view is down to Earth. You see oceans, continents. But there is more, the image is not static or one dimensional. There is movement and texture. In the atmosphere, nitrogen, oxygen, argon and carbon dioxide are the most common gases, alongside less common ones like krypton, xenon and ozone. Weather systems race, eddy and swirl, like milk in a cup of coffee. The greater part of the planet's surface is covered with water, a blur of blue, turquoise, violet, purple and black. On land, vegetation flashes green and yellow, while snow and ice gleam white at the planets poles. Even in the short history of human space exploration, this view has changed. The images you now see will not correspond exactly to those seen by Gagarin just 54 years ago. Weather systems now follow different courses. Seasons come earlier. There is less white at the poles.

Meanwhile down on the Earth's surface, in Paris, there has been another planetary shift, this time in the world of environmental politics. Three days earlier on the 12th of December, two weeks of climate talks ended with the first truly global agreement on climate change. 195 countries committed to take action in response to recent climatic changes. During the last 100 years, the Earth's temperature has risen by 0.5°C. The warming has not been equal across all areas however. Temperatures in the polar regions have increased by 2–3°C in just the last 50 years and its consequences are already being felt. The aim of the Paris talks was to produce a declaration, signed by all nations present, containing legally binding targets to limit further temperature increases. In an unprecedented feat of global diplomacy, and defying the predictions of many, representatives from almost all the countries on Earth ended negotiations by signing this document, pledging to "(hold) the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C".

CLIMATE CHANGE AND WILDLIFE CONSERVATION

Although less obvious than large scale climatic change, no less dramatic are the changes for wildlife. Changes in distribution, timing and synchronicity (more on this in a moment), and consequently changes in interactions between species. Broadly, ecologists are seeing two trends. First, species are physically changing their geographical ranges, shifting both towards the poles, and to higher altitudes. Imagine the rising temperatures as a flood (an analogy all too prescient for many areas) with heat flowing out from the equator, effecting low altitudes first. As the temperatures reach new areas, some species shift northwards, or to higher ground. Some species actually follow the tide line, taking advantage of the advancing warm to colonise new areas as they become climatically clement. For these species, warming will mean a range expansion. For species whose range is restricted however, either by a physical barrier, or because they already inhabit the most northerly

latitudes or highest altitudes, there is nowhere to go. So polar species and those found on mountain tops are in serious trouble and show the highest rates of extinction due to recent climate change.

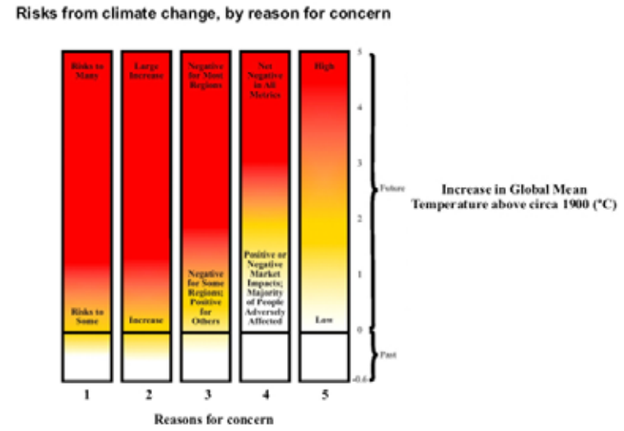
The other major change is temporal. As temperatures increase, some species are beginning their yearly cycles earlier. In a meta-analysis of 203 species in the northern hemisphere, amphibians were found to be bringing their breeding seasons forward more than twice as quickly as butterflies, birds and trees. Meanwhile butterflies are advancing significantly faster than the first flowering herbs. These asynchronies may have serious consequences. For example, just because one species can adapt, this does not mean that other species in its ecological web can do likewise. Butterflies rely on particular plant species, on which to feed and lay their eggs. If these plants have not yet emerged, the butterflies will have no food. Similar issues are affecting many bird species. In Europe, blue tits (*Cyanistes caeruleus*) coordinate the hatching of their eggs with peak caterpillar abundance. Mistiming of laying, due to rapid changes in life cycles of their prey species, is already effecting the reproductive success in these birds. Migratory species may find it even more difficult to adjust their cycles. If the weather is warmer than usual in Africa, will this also be true in Northern Europe? If snows persist in the Himalayas, will it still be winter in the high Arctic? One study found that, of 1598 species, 59% had changed their phenologies and/or distributions over the past 20 to 140 years.

Although less obvious than large scale climatic change, no less dramatic are the changes for wildlife. Changes in distribution, changes in timing and synchronicity, and consequently changes in interactions between species.

CLIMATE CHANGE, CONSERVATION AND A PLAN FOR THE FUTURE

So what relevance do the recent climate talks have for dealing with these ecological changes? Based on available evidence, the Intergovernmental Panel on Climate Change (IPCC) has identified 5 'reasons for concern' (RFCs, described in the appendix below), or the primary ways in which the planet will be affected by climate change. Of particular importance to ecology and biodiversity are RFCs 1 and 3. RFC 1 highlights the 'Risk to Unique and Threatened Systems.', which includes threats to ecosystems, endangered species and biodiversity as a whole. RFC 3 addresses the 'Distribution of Impacts'. This RFC is concerned with the unequal regional impacts of climate change, acknowledging the fact that some will experience greater harm than others, while some may even benefit. In the graph below, predictions for the worsening impacts of each RFC are shown as global temperatures increase. The temperature ranges from just below, to increasingly far above pre-industrial levels, with colour indicating the severity of effect. As the graph shows, ecosystems and regional variations are two of the greatest risks from future climate change, which will experience high levels of impact with relatively minor further increases in temperature.

At a recent international conference, another question was raised – what if different individuals of a species respond differently to climate change? My ears perked up at this point, because such individual differences are my own area of research, but I had not previously thought about this within the context of climate change. We all know that some people cope better than others when the weather is particularly hot. This individual variation in thermal tolerance is also seen in other species, and one would predict that as global temperatures rise, that the individuals that can cope will do better than those that cannot. However, we don't have the data yet to be able to predict how variation among individuals will affect species responses to climate change. So we can model, predict, estimate, and we can have confidence in the results of these studies, as far as they go. But they will never be able to reflect the full systemic and pervasive impacts of climate change.

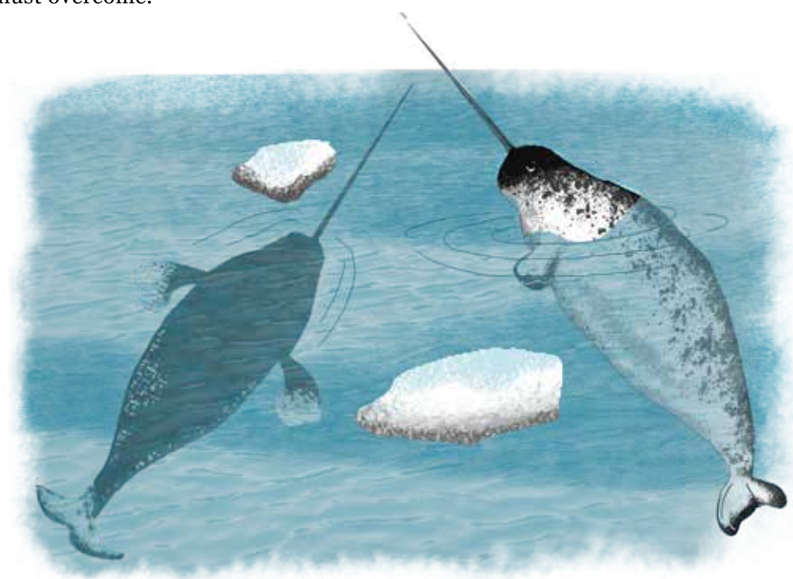


The only thing we can be certain of is that there will be significant environmental changes which all forms of life on our planet must overcome. There are a number of truths we must accept, which ever scenario we see:

1) ***Life as we know it will not continue.***

a. ***Global migration patterns of all species will change***. The distribution of human and non-human species will be forced to adapt to changes in temperature and sea level rise.

b. ***Many species will go extinct.*** We cannot hold life on the planet in stasis, even if we wanted to, and some species will not adapt fast enough to the changing environment. But that is the nature of evolution. Since life first began, it has constantly been evolving in response to changing environmental conditions. We must decide however, how drastic are the changes we are willing to accept. This ranges from the relatively minor changes under a 2°C warming scenario, to a mass extinction, including maybe humans, and the reinitiation of evolution from simple, resistant forms of life. Under this second scenario, life will begin again, adapting to whatever planet it finds after we have gone.



What if different individuals of a species respond differently to climate change? We all know that some people cope better than others when the weather is particularly hot. This individual variation in thermal tolerance is also seen in other species, and one would predict that as global temperatures rise, that the individuals that can cope will do better than those that cannot.

It seems to me that what gives the Paris agreement the greatest chance of achieving its aims is the institution of 5-yearly reviews, to check on the progress being made by each country. The current climate policies of signatory nations are known to be insufficient to hit the 2°C target, and further pledges must be made, and adhered to if it is to be reached. The 5-yearly reviews are designed to ensure our governments are taking the required steps, and where they are not, holding them to account. One of the greatest potential barrier to success therefore will be if these reviews are not properly enforced. So how can we make sure this happens? That is where you, me, everyone comes in. How do you think we can have the greatest impact? Do you already contribute to a particular organisation/petition? Do you write to your local politician? We would love to hear from you, and hope that we might be able to start a conversation about what the most effective form of action for the general public really is. If you have any ideas, you can send them in to us via Facebook (https://m.facebook.com/currentconservation/) or on Twitter (@CurrnConsrvtion; #ClimateConservation).

Together, our voices are much, much louder.

Given that the current rate of warming is unprecedented in the history of life on Earth, we are currently heading towards the more dramatic end of this range.

2) Continued use of fossil fuels ***will*** a) exasperate the climatic changes which we have to respond to, and b) run out anyway. How much the climate changes is down to how much we reduce emissions, and in some cases reverse the effects of greenhouse gases. Any reduction in emissions will lead to lower global warming.

Appendix:

IPCC Reasons for concern

1) Risk to Unique and Threatened Systems. This RFC addresses the potential for increased damage to or irreversible loss of unique and threatened systems, such as coral reefs, tropical glaciers, endangered species, unique ecosystems, biodiversity hotspots, small island states, and indigenous communities.

2) Risk of Extreme Weather Events. This RFC tracks increases in extreme events with substantial consequences for societies and natural systems. Examples include increase in the frequency, intensity, or consequences of heat waves, floods, droughts, wildfires, or tropical cyclones.

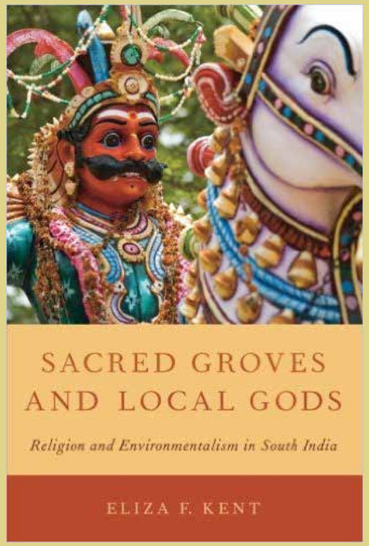
3) Distribution of Impacts. This RFC concerns disparities of impacts. Some regions, countries, and populations face greater harm from climate change, whereas other regions, countries, or populations would be much less harmed—and some may benefit; the magnitude of harm can also vary within regions and across sectors and populations.

4) Aggregate Damages. This RFC covers comprehensive measures of impacts. Impacts distributed across the globe can be aggregated into a single metric, such as monetary damages, lives affected, or lives lost. Aggregation techniques vary in their treatment of equity of outcomes, as well as treatment of impacts that are not easily quantified. This RFC is based mainly on monetary aggregation available in the literature.

5) Risks of Large-Scale Discontinuities. This RFC represents the likelihood that certain phenomena (sometimes called singularities or tipping points) would occur, any of which may be accompanied by very large impacts. These phenomena include the deglaciation (partial or complete) of the West Antarctic or Greenland ice sheets and major changes in some components of the Earth's climate system, such as a substantial reduction or collapse of the North Atlantic Meridional Overturning Circulation.

Matthew Creasey is a PhD Researcher at Centre for Ecology and Conservation, University of Exeter, UK, mjsc201@exeter.ac.uk.

Ecological values through religious beliefs



Sacred Groves and Local Gods: Religion and Environmentalism in South India by Eliza F Kent

ISBN-13:978-0199895489.

New York: Oxford University Press, 2013. 256 pp.

With looming ecological crises and an ever increasing human footprint across the globe, many studies have looked at how communities try to maintain a balance between sustenance and ecology. An unlikely source of ecological insight is religion. Eliza Kent's book looks across Tamil Nadu, India, to understand the phenomenon of sacred groves - small forests or trees set aside for a deity's exclusive use. Sacred groves across India have fascinated many for obvious reasons. In a period when environmental degradation and destruction is the norm, their mere presence, apart from the botanical variety they offer, in densely populated areas can be a source of hope and interest. Religious taboos have played a distinct role in villagers not using these groves in spite of having urgent requirements. Kent shows how the origins of beliefs related to sacred groves lie in the 18th century Tamil country rather than having ancient origins.

Travelling and conversing with villagers across Tamil Nadu, Kent looks at how the sacred groves with linkages to village based Hinduism fare alongside environmental initiatives (CPREEC), governmental control and changing lifestyles.

Complementing Kent's perceptive comments and analytical abilities are the conversations that dot the book. Throughout, she lets the voices of the villagers she converses with sail through, without obstructing them. The remoteness of the places travelled to alongside the photographs in different timeframes (in the early 2000s) also read as an ecological picture of a land that is in rapid change.

Kent maps the connections between written and everyday practices that influence the lives, groves and histories of these communities and places them in the context of modern Tamil Nadu and environmental politics. What emerges is an endearing portrait of attitudes, mythological accounts of temples (sthalapuranas), and histories of communal identities alongside that of the sacred groves.

The deities these sacred groves house are fierce and act as guardians (Karuppaswami-the "dark god") for the villagers. They also possess an ambiguity by invoking fear as well as gratitude among the villagers. Though the deities of these groves are located outside the settled everyday life of villagers as in Madurai and Tiruvannamalai, they nevertheless are linked to the political and social dynamics of the villages. Deities like Mariamman and Kaliamman protect the boundaries as well as the residents from strife and disease.

One of the engrossing chapters looks at the ambivalence of roads, which are routinely depicted as agents of environmental destruction. Roads for many of these communities symbolize progress and a chance to connect with modern lifestyles. But they can also bring about a change in how these deities are perceived and worshipped, thus impacting how the sacred groves are seen and approached. They can considerably weaken the longstanding taboos on the usage of the groves as shown at Attipati. Previously, many villagers avoided these groves due to the dread of dangerous predators and for the fear of causing pollution, 'tittu' to the deities. With significant changes in conceiving as well as approaching space with the development of roads, these practices are seen as illogical by many youngsters. Thus, what was previously believed to house a fierce deity becomes property that is in the control of the temple which requires proper management.

The book also throws light on a familiar theme in environmental politics in India wherein a top-down approach under the garb of 'social forestry' leads to governmental control, leading to the plantation of economically feasible species, thereby reducing the incentive for the protection of the groves for the villagers.

In an interesting as well as a revealing chapter on CPREEC (CPR Environmental Education Centre) in Chennai, Kent throws light on its 'evangelical religious environmentalism' whereby it seeks to 'civilize' the religious practices of the communities in areas where it has taken up the restoration of sacred groves. Sacred groves in Tamil Nadu are dedicated to deities worshipped by non-Brahmin castes and routinely involve animal sacrifices. The Brahmin-origin CPREEC brought various bans against animal sacrifice among the communities, but they decidedly fell flat. In vigorously supporting a ban on animal sacrifice, CPREEC, while seeking to understand the taboos against felling of trees and destruction of groves, denied the same understanding to rituals and sacrifices that play a vital role for the villagers in cementing the bond between them and the deities who are mostly non-vegetarian.

Influential writers such as Madhav Gadgil showed that it was the primitive belief system that helped the groves remained sacred. It was suggested that once this primitive religiosity disappeared to make way for organized religion such as Brahmanical Hinduism, it would lead to the destruction of the groves. Loss of fear and faith are also seen as primary reasons in the gradual chipping away of the taboos against the usage of sacred groves.

However, Kent shows that the stronger the community solidarity, the easier it becomes for the villagers to impose sanctions on degradation or usage of the groves as evident at Urani. Likewise, as groves slip from the control of temple associations and village leaders of cohesive communities and attain devotees from distant areas, they tend to decrease as seen at Puttupattu.

Whatever be the raging debates on the utility and use of the sacred groves, the book throws light not just on the ecological value of these groves but also their relation to village-based Hinduism, which plays a prominent role. And most importantly, it also brings into focus how the villagers themselves feel about the sacred groves and their ecological habitat.

At times, one feels that the book is filled with details that the author could have done away with. But, that would qualify as a minor quibble in a book that is thoroughly researched and beautifully written and one that is more than welcome in an area that is gradually gaining prominence.

Nagothu Naresh Kumar is a Graduate student at Central European University, Budapest.

Interested in conservation issues?

current conservation

A quarterly magazine that communicates
conservation related science
to a wider audience

Current Conservation is published with support from:

dakshin ncbs FES FOUNDATION FOR ECOLOGICAL SECURITY WIPRO Applying Thought ANCF

THE DULEEP MATTHAI NATURE CONSERVATION TRUST ATREE Ashoka Trust for Research in Ecology and the Environment WWF Wildlife Conservation Trust

SUBSCRIBE NOW!

Annual subscription rates for Current Coservation are as given. Please note that cheques and demand drafts should be in favour of Dakshin Foundation.

Dakshin Foundation
A 001, Samvriddhi Gardenia Apartments
88/3 Bytaranyapura
Near Sahakar Nagar A block
Bangalore 560 092
India.
Tel +91 80 11112 34567

To suscribe online, visit our website
www.currentconservation.org

For any queries, write to
subscribe@currentconservation.org

SOUTH ASIA	
INDIVIDUAL	RS. 500
INSTITUTIONAL	RS. 1000
AFRICA, ASIA, LATIN AMERICA	
INDIVIDUAL	US $ 10
INSTITUTIONAL	US $ 25
AUSTRALIA, EUROPE, JAPAN, NORTH AMERICA	
INDIVIDUAL	US $ 25
INSTITUTIONAL	US $ 50