Review

Political transition and emergent forest-conservation issues in Myanmar

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Abstract: *Political and economic transitions have had substantial impacts on forest conservation. Where transitions are underway or anticipated, historical precedent and methods for systematically assessing future trends should be used to anticipate likely threats to forest conservation and design appropriate and prescient policy measures to counteract them. Myanmar is transitioning from an authoritarian, centralized state with a highly regulated economy to a more decentralized and economically liberal democracy and is working to end a long-running civil war. With these transitions in mind, we used a horizon-scanning approach to assess the 40 emerging issues most affecting Myanmar's forests, including internal conflict, land-tenure insecurity, large-scale agricultural development, demise of state timber enterprises, shortfalls in government revenue and capacity, and opening of new deforestation frontiers with new roads, mines, and hydroelectric dams. Averting these threats will require, for example, overhauling governance models, building capacity, improving infrastructure- and energy-project planning, and reforming land-tenure and environmental-protection laws. Although challenges to conservation in Myanmar are daunting, the political transition offers an opportunity for conservationists and researchers to help shape a future that enhances Myanmar's social, economic, and environmental potential while learning and applying lessons from other countries. Our approach and results are relevant to other countries undergoing similar transitions.*

Keywords: agriculture, civil war, forestry, governance, horizon scan, infrastructure, land tenure, priority setting

Temas de Transición Política y Conservación Emergente de los Bosques en Myanmar

Resumen: *Las transiciones políticas y económicas han tenido impactos sustanciales sobre la conservación de los bosques. En los lugares donde se estén llevando a cabo las transiciones o donde se anticipen se deberían utilizar los precedentes históricos y los métodos para evaluar sistemáticamente las futuras tendencias para anticipar las amenazas probables a la conservación de los bosques y para diseñar medidas políticas apropiadas que se anticipen a las amenazas y las contrarresten. Myanmar está en una transición entre un estado autoritario centralizado con una economía altamente regulada y una democracia más descentralizada y liberal, además de estar trabajando para terminar con una guerra civil de larga duración. Con estas transiciones en mente utilizamos una estrategia de escaneo de horizonte para evaluar los 40 temas emergentes que más afectan a los bosques de Myanmar, incluyendo al conflicto interno, la inseguridad de la tenencia, el desarrollo agrícola a gran escala, la desaparición de las empresas estatales de madera, la escasez de ingresos públicos y capacidad, y la apertura de nuevas fronteras de deforestación con nuevas carreteras, minas y presas hidroeléctricas. Para evitar estas amenazas se requerirá de la revisión de los modelos de gobernanza, la capacidad de construcción, la mejora de la planeación de proyectos de energía e infraestructura, y la reforma de las leyes de tenencia y de protección ambiental, por citar algunos ejemplos. Aunque en Myanmar los retos para la conservación son abrumadores, la transición política ofrece una oportunidad para que los conservacionistas y los investigadores ayuden a formar un futuro que mejore el potencial social, económico y ambiental de Myanmar mientras se aprenden y aplican lecciones de otros países. Nuestra estrategia y sus resultados son relevantes para otros países pasando por transiciones similares.*

Palabras Clave: agricultura, escaneo del horizonte, establecimiento de prioridades, gobernanza, guerra civil, infraestructura, silvicultura, tenencia

Introduction

Political and economic reconfigurations can have large and unpredictable effects on a country's deforestation dynamics. Four major transitions—war to peace, authoritarianism to democracy, centralized to decentralized political authority, and economic deregulation may have profound environmental consequences. For example, Indonesia's transition from "centralist authoritarianism to decentralized patronage politics" (Sindre 2014) is associated with increased deforestation (Stibig et al. 2014), and the Soviet Union's dissolution amplified environmental problems in Central Asia (Freedman & Neuzil 2015). The appropriation of forest resources to establish and maintain political patronage networks following democratization in Kenya and the establishment of peace in Cambodia led to accelerated deforestation (Le Billon 2000; Klopp 2012). Myanmar is undergoing all 4 transition types, and other countries are likely to undergo equivalent transitions in the future (e.g., Colombia, Cuba).

Anticipating the likely environmental effects of political–economic transitions can inform proactive policy measures that minimize the risk of negative environmental outcomes. Abrupt transitions (e.g., coups d'états) preclude prior assessments. The gradual nature of Myanmar's transitions, however, provides opportunity for proactive debate and analysis (Webb et al. 2012, 2014; Lim et al. 2017). From 1962 to 2011, Myanmar had a highly centralized, authoritarian state and a command-and-control economy relatively isolated from global markets. From 2011 to 2015, there was some political and economic liberalization, followed by openly contested

elections in 2015 and further reforms which led to the lifting of U.S. economic sanctions. An end to the civil war, which began in 1948, is a possibility following the 2015 Nationwide Ceasefire Agreement between the government and major combatants.

Myanmar's remaining forested area—over 29 million ha, approximately 44% of its total land area and the largest in mainland Southeast Asia (FAO 2015)—is in the globally important and highly threatened Indo-Burma biodiversity hotspot (CEPF 2012; Hughes 2017). Successfully forecasting the effects of Myanmar's governmental and economic transitions on its forests is therefore key to development of new, integrated policy recommendations. Such recommendations will have greater legitimacy if derived from a transparent and formalized approach that yields expert consensus on priority issues. Horizon scanning harnesses the collective knowledge of experts to define emerging environmental and policy issues (Sutherland et al. 2011). However, it has not been applied in countries undergoing political and economic transitions.

We analyzed emerging threats to forests in Myanmar with a horizon-scanning approach to identify the most important issues likely to affect forests in Myanmar over 10 years (2016–2026). We conducted a national-level synthesis of top priorities for research, policy, and interventions to conserve Myanmar's globally important forests and biodiversity while the country undergoes transition. Our findings are globally relevant because they provide a case study for transitions in other nations. Finally, we sought to demonstrate a novel and expanded application of horizon scanning for the conservation and development community.

Methods

The horizon scan followed the methodological framework developed by Sutherland et al. (2011) for collaboratively identifying key conservation issues. Fifty-nine invited experts submitted issues that were subsequently distilled to reduce repetition and returned to the experts for evaluation and submission of additional issues. The resulting 78 issues were discussed by a purposive sample of 33 participants (10 Myanmar nationals, 23 non-Myanmar of whom 8 lived in Myanmar) in a 2-day workshop in 2016. The workshop discussions took place in English, which all participants spoke fluently, and the goal was to identify the 40 most pressing issues. This number was selected to provide a broadly relevant yet manageable document for the Ministry of Natural Resources and Environmental Conservation (MONREC), the Ministry of Agriculture, Livestock, and Irrigation (MOALI), the Myanmar Parliament, local nongovernmental organizations (NGOs), international NGOs, development and aid agencies, and researchers.

Issues were considered according to importance ranks assigned by participants without reference to their novelty. The 78 issues were split into 4 similar-sized themed sets, and the participants divided themselves into 2 groups. Each group discussed issues in the 4 sets and reduced the total number of issues to 52, after which the entire group convened, discussed the issues, and identified by vote the 40 most important issues. Through break-out discussions and group assessment, policy recommendations relative to the 40 most important issues were crafted.

The 40 most important issues were not ranked to avoid pressure to create broader issues (Sutherland et al. 2011) and to allow individual policy makers, researchers, and donors to focus on the themes and issues most relevant to their interests and expertise. Instead, we organized issues thematically so individuals could see the broader picture of threats to forests in Myanmar and key issues within the themes.

Results

The 40 highest priority issues likely to affect forests in Myanmar from 2016 to 2026 (Table 1), organized into 6 broad themes, are discussed in detail.

Land and Agriculture

Tenure insecurity negatively affects forest resources. Growing investment into Myanmar is likely to increase competition for land. Tenure security is weak—smallholder farmers can obtain Land Use Certificates (LUCs) (Table 2), but the state owns all land and can rescind land-use rights (Oberndorf 2012). LUCs have predominantly been granted to lowland Bamar farmers, and only the wealthiest upland farmers have been able to obtain them (Scurrah et al. 2015). Globally, land-tenure insecurity is associated with increased rates of deforestation (Robinson et al. 2014). Lack of land and forest tenure rights for farmers and forest dwellers reduces incentives for long-term sustainable forest resource use and creates a high risk of land seizure for forest conversion.

Large-scale agroindustrial development could lead to widespread forest conversion. Rising human population is increasing pressure to convert forests to agriculture and is driving deforestation in Southeast Asia (Gibbs et al. 2010). The expansion of rubber-tree plantations is currently limited by low rubber prices (Asselt et al. 2017), but rising future demand could make it a long-term threat, particularly if prices increase (Warren-Thomas et al. 2015). Although southern Myanmar does not have an optimal climate for oil-palm cultivation (Saxon & Sheppard 2014), it has become a significant driver of deforestation there (Donald et al. 2015). Other crops, including cashew, coffee, and pineapple, are grown

Table 1. Forty critical emerging issues facing Myanmar's forests (unranked).

Category	*Description*
Land and agriculture	Tenure insecurity for land-users negatively impacts forest resources. Large-scale agroindustrial development could lead to widespread forest conversion. Many agroindustrial investments are fronts for land speculation and resource grabs. Enforcement of social and environmental safeguards for investments in the agricultural sector is needed. Mangroves are being rapidly deforested. Legacy deals from previous administrations threaten forest resources. Deterioration of swidden systems could lead to permanent forest loss. Legal classification of forests may enable conversion.
Infrastructure and energy	Roads are opening new frontiers of deforestation. Poorly designed and constructed infrastructure can exacerbate environmental damage. Rural communities are reliant on forest resources for local energy requirements. Rapidly increasing urban energy demands will increase pressures on forests. Development of hydroelectric power projects could cause large-scale environmental damage. Mining increases exploitation of forests.
Forestry and conservation	Investment in forestry is limited to a small group of actors. The state-run Myanmar Timber Enterprise (MTE) has an uncertain future. Growing domestic demand within an illiberal timber market drives illegal harvesting. Disasters may become more frequent due to losses of ecosystem services. Large-scale timber crop monocultures may drive deforestation. There are gaps in social and environmental science training for foresters. Lack of local engagement may jeopardize forest reserve conservation.
Government	Conflicting agendas among ministries may hinder effective forest conservation. Official data on forests are frequently lacking. Data are poorly coordinated among government sections. Multilevel coordination is needed for integrated multifunctional landscape planning. Forestry and conservation are constrained by insufficient government revenue. Gender is insufficiently considered in conservation and forestry management.
Governance and wider society	Low governance capacity constrains forest conservation. Decentralization of power without decentralization of capacity brings risks. Dysfunctional aspects of the legal system may enable deforestation. Forest management laws are poorly enforced. Planning processes lack bottom-up public participation. Constructive engagement is lacking between government and civil society. Technological advancement has complex environmental consequences.
Civil war	Long-standing civil war affects the implementation of laws and policies. Conflict is tightly linked to questions of resource control. Organized crime and syndicates are engaging in environmental crime. Conservation interventions in disputed areas risk being perceived as illegitimate. Internal displacement is a major social issue with environmental consequences. Opium cultivation threatens forest resources.

successfully in mainland Southeast Asia (Hurni et al. 2017) and could expand into Myanmar. Future agricultural commodity prices, economic liberalization, and suitable climates will determine which crops will expand from 2016 to 2026 and affect large areas of remaining forest.

Many agroindustrial investments are fronts for land speculation and resource grabs, and demand for increasingly limited resources (e.g., land and timber) is increasing. The ease of obtaining agricultural relative to logging concessions incentivizes timber interests to acquire agricultural concessions as a front for timber extraction (Woods 2015*a*). Less than one-quarter of the 1.3 million ha permitted for large-scale agriculture on private lands were planted with crops during 2010–2013 (Woods 2015*a*).

Mangrove forests are rapidly being converted to rice (Webb et al. 2014; Richards & Friess 2016) or degraded by fuel-wood collection (Oo 2002). In the Ayeyarwady Delta, 64% of the 1978 mangrove area was deforested by 2011 (Webb et al. 2014). Improved access to international markets for rice and aquaculture products will further increase pressure to convert the remaining tracts.

Enforcement of social and environmental safeguards for agricultural investments is needed. Rising investment in agricultural is occurring in a regulatory environment in which concessions have been granted without consideration of crop suitability, smallholder livelihoods and property rights, or forest and biodiversity conservation (Burma Environmental Working Group 2011). Newly developed environmental impact assessment (EIA) and national land use policy (NLUP) guidelines are robust and in line with

Table 2. Definitions and abbreviations of legal and political terminology pertaining to forest conservation in Myanmar.

Abbreviation	*Definition*
EIA	Environmental Impact Assessment. A new EIA Procedure was adopted in December 2015, which requires projects with the potential for adverse environmental effects to be screened and EIA to be undertaken of projects above a certain size or in sensitive areas. This includes agricultural and plantation undertakings by businesses, government, or individuals, and other projects which could have an impact on forests (MOECAF 2015). According to these EIA regulations, legacy projects approved before the rules came into place may be required to undertake an environmental audit.
LUC	Land Use Certificates, which can be granted to individual farmers to officially recognize their land use rights under the 2012 Farmland Law.
MOALI	Ministry of Agriculture, Livestock, and Irrigation.
MOECAF	Ministry of Environmental Conservation and Forestry. Now incorporated within MONREC.
MOM	Ministry of Mines. Now incorporated within MONREC.
MONREC	Ministry of Natural Resources and Environmental Conservation.
MTE	Myanmar Timber Enterprise, the state organization responsible for managing the national logging industry. From 1970s onwards was under political pressure to maximize timber revenue, ultimately at the expense of long-term sustainability.
NLUP	National Land Use Policy. Draft version released in 2016. It aims to 'legally recognize and protect legitimate land tenure rights of people, as recognized by the local community, with particular attention to vulnerable groups such as smallholder farmers, the poor, ethnic nationalities and women' The Republic of the Union of Myanmar (2016).
VFVL	Vacant, Fallow, and Virgin Land. Under the 2012 VFVL law, provides a mechanism for land outside of the permanent forest estate that is considered to have never been occupied, or to have been occupied but subsequently been abandoned, to be leased for agricultural concessions or other land uses. This law has been criticized for inadequately protecting land use rights of smallholder farmers, particularly those in communities with various customary tenure arrangements that have not been formally recognized by Government authorities, such as shifting cultivation practices (Oberndorf 2012; Woods 2015*a*).

international best practice, but building the regulatory and technical capacity to implement and enforce them will be a major challenge.

Deals from previous administrations threaten forest resources. Many infrastructure, logging, and agricultural projects were granted without legitimate environmental assessment as part of patronage networks under the recent administration (2011–2016) or previous military rule. Environmental damage will likely result, unless EIA guidelines are applied retroactively or these projects are canceled.

Deterioration of swidden agriculture—traditionally the dominant agricultural system in upland Myanmar—could lead to permanent forest loss. It remains uncertain whether abandonment of swidden will lead to secondary forest succession (as has occurred in northern Chin state), permanent forest loss (van Vliet et al. 2012), or conversion to short-rotation tree crops, such as *Acacia* (Lambin & Meyfroidt 2010), as has occurred elsewhere in Southeast Asia.

Contradictory and unclear land classification may enable forest conversion. In legally unclassified land, trees are owned by the Forest Department and land is owned by MOALI, leading to interministry conflict over land use (Woods 2015*a*). Untitled forested or small-farm land (including swidden) may be designated as "vacant, fallow, or virgin land" (VFVL) under the 2012 VFVL law and reallocated for agricultural concessions by the Central Land Management Committee (Oberndorf 2012; Woods 2012).

Infrastructure and Energy

Increasing foreign investment will lead to building of new roads through previously isolated wilderness and create new deforestation frontiers (Laurance et al. 2009). Ongoing construction of roads linking Dawei to Bangkok and Myeik to Dan Singkhon for example, is cutting through one of the largest remaining contiguous blocks of forest in Southeast Asia.

Poor planning and engineering will exacerbate the negative effects of new roads. For example, the Thingannyinaung-Myawaddy road bisects protected areas (PAs) in the Western Forest Complex in Kayin State (Burma Environmental Working Group 2011). Low-quality road design and engineering can amplify soil erosion and mass wasting on roads and increase vulnerability to forest fires (Helsingen et al. 2015).

Rural-community reliance on forests for energy is increasing. Most of Myanmar's energy comes from forest resources, which contributes to forest loss and degradation (UNDP 2013). Rising population and per capita energy consumption associated with economy growth and urbanization will increase total demand unless access to alternative energy sources is improved (Sovacool 2013).

Rapidly increasing urban energy demands will increase pressures on forests. The proportion of Myanmar's population living in large cities is expected to increase from 13% in 2013 to 25% by 2030 (Chhor et al. 2013). The rising needs of these urban centers—whose energy needs are currently met by forest resources—are likely to lead to

deforestation and forest degradation unless the national energy sector is significantly reformed.

Development of hydroelectric power could cause large-scale environmental damage. Rising domestic and regional electricity demands and desire for foreign currency will create enormous pressure to tap the power-generation potential of Myanmar's rivers. Several projects have been proposed, including the 7000 MW Tasang Dam, which would be the tallest in Southeast Asia (Molle et al. 2012). Elsewhere in Asia dams built on main streams and tributaries have resulted in substantial losses of forest, fish biodiversity, and local livelihoods and increased disease risk (Ziv et al. 2012; Webber 2012; Ziegler et al. 2013).

Mining increases exploitation of forests. Myanmar's rich mineral deposits have not been fully explored or exploited (Gardiner et al. 2014). Although mining leads to relatively little direct forest loss (LaJeunesse Connette et al. 2016), it attracts large numbers of people to wilderness frontiers and furthers forest-resource exploitation, as observed in the Hukaung valley for small-scale gold exploration (Papworth et al. 2017).

Forestry and Conservation

Forestry investment is limited to a small group of actors. Political control over forestry has been centralized and top-down (Bryant 1997). Communities have only limited use rights in community-managed forests and no use rights outside of them. Exclusionary forestry policies have undermined inclusive economic development and diminished incentives for sustainable forest management by local communities (Woods 2013), a disconnect that will hinder future forest management.

Unsustainable exploitation since the 1970s has depleted Myanmar's timber stocks and the state-run MTE is likely to dissolve. This has potentially enormous economic and environmental consequences: MTE employs 35,000–60,000 people and 2,280 working elephants (Myanmar Statistical Yearbook 2015). Providing employment outside of logging for people and elephants following the closure of MTE and pensions for former employees will pose an enormous economic burden and unprecedented conservation challenge (Springate-Baginski et al. 2016).

An illiberal market is driving illegal harvesting. The MTE timber is distributed via Myanmar Timber Merchants Association to large and well-connected enterprises. Those that cannot obtain timber this way must buy it on the black market for 2–3 times more (Woods 2013). Rising domestic demand from wood-based industries and construction may be met by growing informal trade of illegally harvested timber.

Frequency of disasters may increase as ecosystem services are lost. Myanmar ranks second among countries most affected by extreme weather events from 1995 to 2014 (Kreft et al. 2016). Continued conversion of low-lying forests (including mangroves) to aquaculture or agriculture may increase potential damage from cyclones and monsoon floods (Tan-Soo et al. 2014). Forest loss on slopes will increase the risk of landslides (Sidle et al. 2006; Ziegler et al. 2009) and, if accompanied by a drastic loss of infiltrability on hillslopes and urbanization, may exacerbate flood risk (van Dijk et al. 2009).

Large-scale timber monocultures, particularly of nonnative species, may drive deforestation and environmental damage. Imminent depletion of commercial teak forests may incentivize the creation of timber plantations and result in biodiversity loss, reductions in carbon stocks, accelerated erosion, and changes in soil hydrology (Jackson et al. 2005; Sidle et al. 2006; Bremer & Farley 2010).

Gaps exist in social and environmental science training for foresters. Environmental management and conservation are unlikely to succeed without an understanding of human behavior (Adams 2007). Forest manager training still focuses on the technical aspects of forestry; training in social sciences, conservation science, and environmental and development issues is needed to improve the design and local implementation of forestry and conservation policies.

Lack of local engagement may jeopardize conservation in forest reserves. Forest reserve management focuses on establishing and patrolling borders, punishing illegal harvesters, and creating a visible presence at headquarters and in local townships (Allendorf et al. 2006). This strategy overlooks opportunities for local engagement. Improved forest management requires acknowledging and nesting local management systems (including property rights) within existing state management regimes.

Government

Conflicting goals among ministries may hinder forest conservation. For example, the Ministry of Mines (MOM) granted permission for an asbestos mine in an area designated for community forestry by the Ministry of Environmental Conservation and Forestry (MOECAF) (Callahan 2007). These ministries have been amalgamated into MONREC, but this agency still has fundamentally different goals from MOALI. The former promotes forestry and conservation and the latter promotes agricultural expansion (Woods 2015*a*).

Official data on forests are lacking. Vegetation and habitat classifications, forest and timber harvest volumes (including from contentious agricultural concessions [Woods 2013, 2015*a*]), and biodiversity data are cornerstones of science-based management plans. Although nongovernment analyses have attempted to fill this large information gap, they focused on high-priority conservation areas (Tordoff et al. 2012).

Data coordination across government sources is poor. Lack of standardized protocols or formats for sharing data within or between departments has led to contradictory data from different government sources (Woods 2013) and is likely to constrain effective future policy action.

Shortfalls in the coordination of data and harmonization of policies are a key barrier to integrated multifunctional planning necessary for efficient land-use planning. Coordinating the allocation of areas to contrasting uses such as forest conservation, timber harvesting, and agriculture will require the coordination of different departments and offices at national, state, and district levels.

Forestry and conservation are constrained by insufficient government revenue. Reformation of sustainable forestry and conservation will be an enormous challenge. Although logging generated large amounts of foreign-exchange revenue, unsustainable exploitation of forest resources has diminished prospects for future revenue. New sources of revenue are needed to support the Forest Department and other agencies and the hiring, training, and retention of staff and to enforce government policies.

Governance and Wider Society

Low governance capacity is underpinned by a long-neglected education system and a lack of investment in human-resource development (Chhor et al. 2013). Concentration of capacity in Naypyidaw and Yangon will severely constrain the design and implementation of decentralized land-use policies and staffing of local forest-department offices.

Decentralization of power without decentralization of capacity risks diluting capacity and resources for planning and enforcement and strengthening the political and economic position of local elites. Decentralization of forest management and conservation is likely to occur as part of Myanmar's democratic transition.

Gender is insufficiently considered in conservation and management. The ways gender affects sustainable natural resource management is complex and highly context dependent (Meinzen-Dick et al. 2014). For example, greater female participation is associated with relatively high forest cover in community forestry programs in India and Nepal (Agarwal 2009), but women near PAs in Myanmar were less likely than men to perceive conservation benefits from PAs (Allendorf & Allendorf 2013). Natural resource management and decision making requires input from all people affected by these decisions. Failure to consider gender in conservation and forest management where women are substantially underrepresented in positions of power could have negative social consequences and lead to suboptimal management and conservation outcomes.

Public participation is lacking in planning processes. Key land and forestry policy reform is on the horizon, yet governance models remain top down. Although a 2012 law allows village tract administrators to be elected indirectly, the administrators of townships (the key unit of local planning and administration) are appointed by the General Administration Department (UNDP Myanmar 2015). Furthermore planning and budgeting for different government sectors typically happens at the ministry level, and the local administration is tasked with implementation (UNDP Myanmar 2015). Although decentralization carries risks, the lack of downward accountability in local governance and local participation in planning may undermine the legitimacy of reforms.

The lack of constructive engagement between civil society (e.g., community-based organizations advocating for local land rights) and government decision makers has the potential to undermine the legitimacy of government policy, including forest policy. For example, the window of opportunity for public input on law-reform laws is insufficient (Franco et al. 2015).

Rapid technological advancement (e.g., increase in mobile phone ownership from 4 to 57% from 2012 to 2015 ([Deloitte 2013; GSMA 2015]) is transforming society and may have environmental effects. Although online social networks could facilitate illegal wildlife trade (Krishnasamy & Stoner 2016), they may also aid reporting of wildlife crime and the spread of conservation values (Nghiem et al. 2012). Advanced renewable-energy technology may facilitate electrification of remote areas. Remote sensing (Rose et al. 2015), drones (Marvin et al. 2016), and DNA barcoding (Kress et al. 2015) represent innovative technologies with profound conservation implications.

Judicial capacity is low, corruption is rife, and fundamental aspects of the rule of law (e.g., clear, noncontradictory legislation whose implementation is congruent with its apparent meaning) are lacking (Cheesman 2015). For example, legislation is ambiguous as to the legal status of timber from agricultural concessions, and a system of rule by decree allows ministers to declare timber as legal on an ad hoc basis (Woods 2015*a*).

Forest-management law enforcement is insufficiently funded. Demand for and access to forestry products will increase with the opening of Myanmar's economy, and illegal logging and trafficking across international borders is expected to increase concomitantly. For example, insufficient funding of MONREC for monitoring and law enforcement has enabled illegal logging and forest conversion to flourish (UNODC 2015*a*).

Civil War and Breakdown of Law

Ongoing civil war since 1948 created areas, particularly near borders, beyond government control (Callahan 2007), which has enabled forest conversion. However, nonstate armed groups (e.g., Karen National Union) have implemented their own resource-management laws,

policies, and PAs, sometimes protecting forest more effectively than the central government. Peace may have complex effects on forests, bringing some areas under greater environmental-law enforcement and in others enabling legal logging and agricultural concessions.

Conflict is linked to resource control. Contested borderlands contain some of Myanmar's richest timber reserves and are well connected to domestic markets in China and Thailand. This has attracted high levels of illegal logging, which has provided revenue for armed groups (Global Witness 2002). That natural resources are serving as incentives and enablers of conflict is exemplified by the way past cease-fire agreements have been used as opportunities to create space for agricultural concessions in previously contested areas, often at the expense of smallholder land rights and forests (Woods 2011). Sharing agreements for natural resources can improve the stability of peace accords (Billon & Nicholls 2007). Equitable distribution of forest management responsibility and profits in future peace agreements will strongly influence prospects for forest conservation and lasting peace.

Weak rule of law, particularly in conflict zones, has created opportunities for syndicates to profit from environmental crime. Forests are threatened by a thriving cross-border trade in illegal timber that is carried out by a network of Chinese business people, Kachin Independence Organization, Myanmar National Army, and the Myanmar government (EIA 2015). Environmental damage can be exacerbated where proceeds are laundered through the purchase of land concessions.

Conservation interventions in disputed areas could be considered illegitimate. Attempts by conservationists to support the creation of PAs in land outside government control (e.g., parts of Tanintharyi and Kachin) may be seen by local groups as attempts to establish government control over their land. Great care will be needed to ensure that conservation interventions are conducted with the participation of local groups (Woods 2015*b*).

Internal displacement has environmental consequences. Civil war has internally displaced approximately 640,000 people and driven 415,000 people abroad as refugees (IDMC 2014; Jolliffe 2014). If the peace process is successful, many will likely return to their land. However, these lands may be occupied, set aside for conservation, or be otherwise unsuitable for reoccupation, creating a new wave of internally displaced people seeking alternate land and livelihoods elsewhere and leading to possible forest clearance (Woods 2016).

Opium cultivation threatens forest resources. The area under opium now covers 55,500 ha (UNODC 2015*b*). Chinese-funded opium substitution programs, which aim to provide alternative livelihoods for opium farmers, in practice have subsidized Chinese acquisition of land for cash crops such as rubber and led to deforestation (Woods 2012).

Discussion

Our identification of the most important issues likely to affect Myanmar's forests during the early stages of the ongoing transition creates an opportunity for Myanmar to avoid high levels of deforestation. This could improve conservation outcomes in Myanmar and help nations undergoing similar transitions. Our discussion of emerging issues draws from historical experiences in other countries, and Myanmar's experience over the next 5–10 years will be relevant for other countries undergoing transitions, such as Colombia, where the government has signed a treaty with FARC to end the civil war, and Cuba, which has embarked on liberal economic reforms. We recommend the following targeted policy interventions to proactively address these threats before they result in rapid deforestation (Table 3) and to mitigate or prevent negative environmental outcomes.

Land and Agriculture

We recommend the incorporation of the following key principles into a comprehensive land-reform law: First, implement EIAs before allocation and development of large-scale agricultural concessions. Second, ensure greater transparency on concession allocation and concessionaire identity. Third, improve land-tenure security.

New regulations will require EIAs for projects above a certain size or in sensitive areas (MOECAF 2015) and should help minimize threats to forests from future investments provided procedures are adequately and consistently implemented. Nongovernmental organizations, donors, and civil society can support these efforts by developing awareness and capacity within relevant regulatory bodies. Environmental damage may also be minimized by retroactively applying EIA guidelines (Article 8 of EIA procedure) to deals granted under previous administrations without social and environmental considerations.

Many of the documented abuses of agricultural concessions—conversion of environmentally valuable forests, dispossession of smallholders, use as a front for illegal logging, and disproportionate benefits to the politically well connected (e.g. Woods 2011, 2015*a*)—are enabled by a lack of transparency. Creation of a publicly available registry for agricultural concessions with details of concessionaires, concession purpose and boundaries, and proof that EIA procedures were followed and that legitimate land-tenure rights were respected would introduce accountability and increase the probability that existing laws are respected.

The NLUP is intended to enshrine in law and planning policy the principles of tenure security and sustainable environmental conservation (NLUP 2016). Establishing legal pathways to acquire indisputable land tenure is a

Table 3. Key themes of critical emerging issues facing Myanmar's forests and policy solutions to address them.

Issues	*Policy recommendations*
Pressure for agricultural expansion coupled with tenure insecurity and insufficient environmental safeguards.	Develop capacity for new EIA procedures and apply them retroactively to legacy deals (or cancel legacy deals). Create registry of land concessions to increase transparency and accountability. Develop legal frameworks to protect smallholder land tenure.
Development of transport, energy, and mining infrastructure.	Careful spatial planning of infrastructure needed to ensure environmental damage is minimized. A short-term moratorium on large-scale hydroelectric projects would avoid major environmental damage while Myanmar reviews its national energy strategy. Mining companies could be required to pay bonds upfront as a guarantee that they cover any environmental costs from the mines.
Unsustainable logging and insufficient engagement of local communities with forestry and conservation.	Forest Policy should be updated to move beyond timber exploitation and include forest recovery, conservation, and ecosystem services. Forestry and conservation projects should involve local communities.
Government policy hampered by lack of mechanisms for data sharing and policy co-ordination between departments.	Develop standardized protocols for data collection, formats, digitization, and storage to increase government efficiency and capacity for interministry policy coordination.
Lack of capacity for governance and rule of law, particularly under future decentralization.	Moves towards decentralization of administration should be facilitated such that plans, rules, and capacity are methodically transferred along with power. Develop more effective governance arrangements that enhance transparency at all levels.
Fate of forests in Myanmar tightly linked with internal conflict.	Control of forest resources must be explicitly incorporated into peace negotiations. Conservationists can assist by helping to develop capacity on both sides.

necessity during transition. Liberia, in their encouragement of direct foreign investment after their civil war, failed to recognize customary land tenure. Smallholders lost land to large foreign interests, and this fueled social grievances and failed to alleviate rural poverty (Paczynska 2016). Tenure reform will be needed in Myanmar to avoid such negative social and environmental impacts.

A remaining challenge is the universal allocation and registration of LUCs through available technology and simplification of required procedures (Oberndorf 2012) that follow examples of best practice (Hall & Scoones 2016) and avoid the formalization of land grabs that occurred elsewhere (e.g. Cambodia, Dwyer 2013). A moratorium on the allocation of new concessions in areas where there have been insufficient opportunities or time to recognize, protect, and register legitimate land-tenure rights would help guard against unfair and illegal land confiscations. In Indonesia, for example, a moratorium on new concessions proved effective in slowing deforestation (Busch et al. 2015). Experience in other transition countries suggests there are gaps between rhetoric, legislation, and the ability to develop governance structures on the ground; significant donor, civil society, and state commitments are needed to achieve all the initiatives we suggest (McCarthy & Robinson 2016).

Infrastructure and Energy

Although transport and electricity infrastructure is necessary for economic development (Chhor et al. 2013), deforestation in the Amazon, central Africa, and Australasia has been catalyzed by roads and other linear clearings (Laurance et al. 2009). Infrastructure policy can minimize these threats by requiring spatial-assessment tools that can identify appropriate road and electric-grid networks that deliver social and economic benefits while reducing environmental costs (e.g., a recent exercise in Nigeria identified alternatives to a proposed major highway that would be cheaper and less environmentally destructive [Mahmoud et al. 2017]). Requiring the adoption of improved road design reduces environmental damage—such as soil erosion, slope failure, and forest fragmentation—that is often associated with new roads, particularly in mountainous areas (Sidle & Ziegler 2012; Helsingen et al. 2015).

Providing regular electricity to all of Myanmar's population while still conserving forests is a key challenge. Although hydropower could generate large amounts of electricity, much of the electricity from proposed dams is slated for export and would do little to alleviate electricity shortages in country (ADB 2013). Hydropower development in the Yangtze, Mekong, and Amazon basins has devastated forests, freshwater biodiversity, and the livelihoods of displaced people (Finer & Jenkins 2012; Webber 2012; Winemiller et al. 2016). Myanmar has an opportunity to avoid these consequences. A short-term moratorium on planned but not yet constructed dams would provide time for the government to review planned dams and the opportunity to develop integrated catchment-based water-resource policies that identify the risks and constraints of hydropower capacity. In the longer term, hydroelectric capacity should be reviewed within a comprehensive national energy-resources strategy that includes transparency related to existing hydropower investments and that incorporates predicted effects of dams on forests and biodiversity in planning (Winemiller et al. 2016).

Harnessing Myanmar's abundant natural gas (0.3 trillion m^3 proved reserves [BP 2015]) for electricity generation in the short to medium term may be a better way to generate electricity with less damage to forests; the long-term goal would be implementing advanced renewable technology. A related energy problem is fuelwood and charcoal consumption. Solutions include the development and financing of community wood lots (Sovacool 2013) and encouraging transition to other energy sources. A review of fuel transitions in a range of countries (e.g., India, Vietnam, Honduras) shows that electrification reduces household consumption of solid fuels (Heltberg 2004). Insufficient energy infrastructure in remote rural settlements may be resolved through off-grid solutions, such as rice-husk biomass power plants, small household solar cells, and distribution of liquid petroleum (Sovacool 2013; Pode et al. 2016).

Mining causes pollution and deforestation (Swenson et al. 2011; Edwards et al. 2014). Impacts of the commercial mining sector could be reduced by using enhanced spatial assessment tools to avoid mines in sensitive areas and passing and enforcing regulations that limit environmental impacts during mine construction and operation. Adoption of best practices for the operation and restoration of commercial mines, perhaps enforceable by upfront payment of bonds for subsequent restoration by mining investors, is a critical step forward. Problems related to the large informal mining sector also need to be addressed through improved environmental law enforcement and governance and by providing for livelihood needs of people.

Forestry and Conservation

The new political climate and the 2014 log export ban have created an opportunity to revise Myanmar's 1995 Forest Policy and expand its scope to encompass forest recovery, biodiversity conservation, ecosystem services, domestic timber demand, and equitable benefit sharing among stakeholders. Forestry reform should begin with increased transparency of resource extraction, such as identification of concessionaires and publication of their rights and responsibilities, and volume of timber extracted from the conversion of unclassified forests into agricultural concessions.

Additional policy reforms in the forestry sector require incorporating MTE in a new national forest recovery vision that includes nonpreferential corporatization of the timber-extraction sector (Springate-Baginski et al. 2016), offsetting declining forestry revenues with gains from payments for forest ecosystem services, and reforming the domestic timber market to remove administrative hurdles that promote an informal market with de facto open-access resource extraction (Springate-Baginski et al. 2016). Furthermore, updating the Community Forestry Instructions could help provide the tenure security and benefit sharing required to incentivize sustainable resource management (Pagdee et al. 2006).

A national forest-restoration and -recovery plan—including mangrove polyculture and agroforestry—that ties into watershed management, domestic timber demand, and land-use planning should be developed and implemented. Existing forest monocultures, although important for economic development, should not be included in government forest-cover statistics or in national targets. Forestry monocultures have limited biodiversity value and should be avoided (McElwee 2009; Hua et al. 2016). Instead, where feasible, enrichment planting allows natural forest recovery. Moreover, reforestation must incorporate recognition of local tenure rights, traditional species preferences, and equitability in the selection of reforestation sites so as to avoid the pitfalls of previous reforestation schemes across Asia, which in some cases created perverse incentives to degrade natural forests so that they qualified for reforestation and led to the displacement of smallholders by rent-seeking elites (McElwee 2009; Barr & Sayer 2012).

The long-term prospects of the PA network will be enhanced by increasing the levels of engagement between PA managers and local communities (Allendorf et al. 2012). A global meta-analysis showed that community participation was the only significant predictor of compliance with PA policies (Andrade & Rhodes 2012). Within conflict zones, PAs can take on political significance when they are perceived as zones of direct government control. Integrating PA networks created by nonstate combatants with these with the national PA network could expand the area of PAs with local legitimacy and contribute to a lasting peace deal. Expanding the remit of the Forest Department to cover the social and ecological issues that intersect with forestry should be accompanied by a broader education base, particularly in the social sciences. Achieving this will require commitment of the Ministry of Education and support from foreign educational institutions.

Government, Governance, and Society

Myanmar's transition offers opportunities for the radical improvements in governance needed to effectively manage its forests. Although well-managed decentralization of natural resource decision making can improve social equity and incentivize conservation (Phelps et al. 2010), decentralization is no panacea, as demonstrated in Indonesia, where decentralization in the wake of the New Order regime resulted in contradictory legislation and unclear demarcation of authority over natural resources and widespread incentivization of short-term forest exploitation (McCarthy & Moeliono 2012). Elsewhere transparency, accountability, and representativeness of the local authorities heavily influence outcomes of decentralization (Agrawal & Ribot 1999). It is critical therefore that

decentralization of authority over forests is clearly and carefully accompanied by transfer of plans, rules, responsibility, and capacity for sustainable management. Governance capacity could be fortified by providing scholarships to the new generation of policy makers, lawyers, and judges (particularly in environmental law).

Effective decentralized governance requires support for bottom-up planning within a policy framework established at the national level. Best practice for planning could be developed at the township level. This requires building trust and developing informal channels for dialogue (to build relationships) and formal structures for multi-stakeholder engagement (for transparency and effective implementation) and guidelines for public access to information. Measures to ensure women participate in consultative and decision-making processes over natural resource management could enhance social equity and lead to better sustainable forestry outcomes (e.g., community forestry programs in India and Nepal [Agarwal 2009]).

Data sharing across government bodies is essential for efficient and consistent governance. Open access to data and policy documents on regularly updated ministry websites would increase the transparency needed to support effective local administration (particularly under decentralization) and to broaden public and civil-society involvement in government decisions (Ríos et al. 2016). Standardizing protocols for data collection, formats, digitization, and storage would increase government efficiency and capacity for interministry policy coordination (e.g. mandating the use of Unicode to represent Myanmar script in government documents). The on-going OneMap Myanmar is a good example of the work needed. This project, funded by the Swiss Agency for Development and Cooperation, aims to consolidate spatial information by combining data from different government ministries and NGOs with participatory mapping projects with local communities to consolidate data on land cover and land tenure. These data will be openly accessible online so that all levels of society can access high-quality spatial information about land in Myanmar (http://www.cde.unibe.ch/research/projects/onemap_myanmar/index_eng.html).

Reform is needed at the highest levels of governance. The recent merger of the MOM and MOECAF to form MONREC may improve coordination of policies and facilitate data sharing between departments. However, competing interests of different ministries for the same land remains a key challenge (Woods 2015*a*). Indonesia's failure to coordinate policies between departments exacerbated environmental damage (McCarthy & Moeliono 2012). Explicit policy-coordination mechanisms must be developed to facilitate cross-ministry coordination and intervention strategies. This process could first target areas of overlapping interest between ministries, such as protecting mangroves for forest conservation, fish breeding, and natural-disaster mitigation and preventing landslides and forest fragmentation due to new road construction.

Revenue underpins most policy solutions and requires equitable distribution from central funds to MONREC. Forest conservation could provide ecosystem services worth US$20 billion over the next 20 years (Emerton & Aung 2013) provided that ways to harness the economic value of these ecosystem services are found. One mechanism is to earmark revenue from all departments that affect forests (such as MOALI and the Ministry of Energy), particularly for issues that affect multiple departments such as desertification and natural disasters. Alternative strategies include payment for ecosystem services (e.g., carbon sequestration) by investors, tourism, oil and gas, or infrastructure development (Emerton & Aung 2013).

An issue central to revenue and good governance is corruption. Georgia's recent anticorruption reforms demonstrate that corruption can be dramatically reduced in the public sector by systematically reforming corrupt agencies through zero-tolerance policies, replacement of corrupt employees, and minimizing opportunities for corrupt interactions provided that reformers have the political will and power to overcome resistance from those who benefit from corruption (World Bank 2016).

Civil War

Policy needs to address forest overharvesting during war and take measures to minimize postwar, large-scale forest conversion. The former may be addressed through international cooperation to reduce the flow of illegal timber exports, particularly with China, although Chinese national and prefecture governments may have different agendas for the development of northern Myanmar (Woods 2011). The cease-fire agreements of the 1990s set a negative precedent for forest conservation by creating an opportunity for the Union military to establish de facto territorial control in previously contested areas, particularly through the creation of large-scale agricultural concessions. To avoid repeating this outcome, control over forests must be explicitly included in the decentralization agreements likely to accompany a lasting peace deal. Decentralization of authority over forests should be accompanied by decentralization of responsibility and technical capacity for sustainable management and conservation.

A lasting peace means the future livelihoods of returning IDPs and refugees need to be considered. Under the international Pinheiro principles adopted in the 2014 KNU Land Law, returnees are entitled to their original land or that of their displaced ancestors. However, this conflicts with Myanmar's land laws, which are based on use rights rather than ownership rights, giving priority to existing occupants (UNHCR 2016). Resolution of these conflicts may be tied to land-reform laws, but either

precept is likely to require the creation of new settlements and livelihoods for hundreds of thousands of displaced people (UNHCR 2016). Technical assistance for the spatial planning of new settlements and the development of sustainable livelihoods could be key to assisting returnees and minimizing the environmental and livelihood risks of large-scale unplanned migration to forest frontiers.

The problems of conflict-fueled forest exploitation and the need to consider the future of forests in eventual peace deals are relevant to other countries (e.g., Democratic Republic of Congo and Central African Republic). Recently, Colombia, which has large areas of forest and an estimated 2.6–4.4 million IDPs (Carillo 2009), negotiated an end to a civil war that began in 1962. The emerging issues and policy solutions we present here for Myanmar are relevant to other countries embarking on major transitions.

Summary

We provide avenues toward new policy visions in Myanmar that will effectively and equitably balance smallholder livelihoods, agriculture, forestry, energy, and infrastructure development with forest conservation. Assistance with financial capital, education, and technical support may be the most effective way to contribute to the policy visions and actions Myanmar will need to conserve its forests.

Although our horizon scan focused on potential threats to forests in Myanmar, there are reasons to be optimistic about the prospect of improved environmental stewardship. Compared with other countries in Southeast Asia, Myanmar still has a large area of remaining forest, a commitment from the government to manage the remaining forest reserves (including expansion of the PA system), a popular will for conservation, and the opportunity to learn from historical mistakes made by other counties. Looking ahead to probable future challenges, informed by historical analogues, provides an important tool to inform policy in a way that can anticipate and avoid widespread environmental damage. We believe this approach and the example of Myanmar from 2016 to 2026 will be relevant for other countries undergoing, or yet to undergo, economic and political transitions.

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