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Short communication

Hidden challenges for conservation and development along the Trans-Papuan economic corridor

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ABSTRACT

The island of New Guinea harbours one of the world's largest tracts of intact tropical forest, with 41% of its land area in Indonesian Papua (Papua and Papua Barat Provinces). Within Papua, the advent of a 4000-km 'development corridor' reflects a national agenda promoting primary-resource extraction and economic integration. Papua, a resource frontier containing vast forest and mineral resources, increasingly exhibits new conservation and development dynamics suggestive of the earlier frontier development phases of other Indonesian regions. Local environmental and social considerations have been discounted in the headlong rush to establish the corridor and secure access to natural resources. Peatland and forest conversion are increasingly extensive within the epicentres of economic development. Deforestation frontiers are emerging along parts of the expanding development corridor, including within the Lorentz World Heritage Site. Customary land rights for Papua's indigenous people remain an afterthought to resource development, fomenting conditions contrary to conservation and sustainable development. A centralised development agenda within Indonesia underlies virtually all of these changes. We recommend specific actions to address the environmental, economic, and socio-political challenges of frontier development along the Papuan corridor.

1. Introduction

A regional 'development corridor' and associated Trans-Papuan Highway are emerging in Indonesian Papua (Papua and Papua Barat Provinces). This corridor is one of a series being pursued nationally (CMEA, 2011), reflecting national aspirations for resource and land exploitation (Alamgir et al., 2018; Negara, 2016) and broader global trends in infrastructure development (Alamgir et al., 2017; Clements et al., 2014; Laurance and Burgués, 2017). Like other large-scale infrastructure initiatives (Ascensão et al., 2018; Laurance et al., 2015; Sloan et al., 2016), the Papuan corridor is raising concerns over environmental degradation and equitable economic development (Pattiselanno and Arobaya, 2015).

We identify three important but poorly observed challenges for the sound development of the Papuan corridor: (*i*) peatland conservation amongst agro-industrial development, (*ii*) unresolved land claims threatening social equity and local economic development, and (*iii*) the emergence of deforestation frontiers and corridor routes of dubious merit. These challenges exemplify discord between national and regional agendas associated with Papua's status as a resource frontier of unique social and environmental conditions. We conclude with proposals addressing some of the key challenges to conservation and development along the corridor.

2. The Papuan corridor and resource frontier

Papua is a largely undeveloped forested region that has long been managed as a national resource-extraction frontier. It has been the focus of numerous forestry, agricultural, and mining mega-project proposals spanning tens of millions of hectares over recent decades (Carr, 1998; EIA, 2006; Rulistia, 2008). Driven largely by commercial interests, most of these failed to materialise in the face of protest over environmental or indigenous issues or the global financial crisis of the late 2000s. The Papuan corridor differs critically in that it is driven by a national development agenda underlain by concerns over food, energy, and resource security. Once completed, the corridor will link growing nodes of food/biofuel agriculture, mining, oil/gas extraction, forestry, and aquaculture via ~4000 km of highway crossing vast forest tracts

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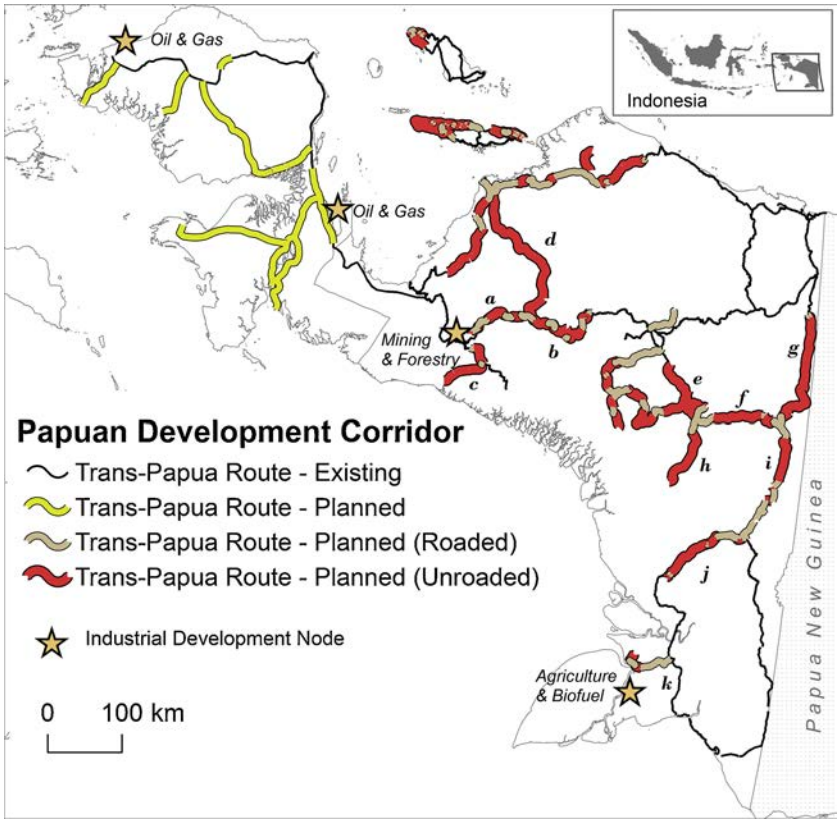

Fig. 1. The Trans-Papuan Corridor and major zones of planned economic expansion. Corridor routes are labelled by status (planned, existing) and, for Papua Province, by whether planned routes are already roaded in some form or not (roaded, unroaded).
Notes: Letters denote individual planned segments of the Trans-Papuan network. Segments *d* and *g* as well as planned routes in Papua Barat Province (at left) south of the main highway are provincial routes whose status is least certain. Data sources differ by province. For Papua Province (at right), 2013 Trans-Papua routes were according to the Papuan Regional Body for Planning and Development (BAPPEDA). These planned routes were spatially precise and so were inspected in Google Earth to label their segments according to whether they traversed unroaded forest or natural vegetation ('unroaded') or ran along existing roadways ('roaded'). In the later case of planned segments that appeared to be already roaded, road condition was not readily observable. Hence it is unknown whether roaded planned segments were recently constructed or are still pending upgrades. Google Earth imagery was generally for 2016 or earlier. In Papua Barat Province, 2016 Trans-Papuan routes are according to the Ministry of Public Works. They are spatially approximate and so were not inspected in Google Earth.

(Fig. 1). In Papua Province, where planned routes of the corridor are precisely known, most planned routes appear to be unroaded and forested according to high-resolution satellite imagery of ca. 2016, with the remaining planned routes appearing already roaded in some form (Fig. 1). Supportive investments of $11.6 billion in secondary roads, ports, power generation, water sanitation, irrigation, and airports are already underway at various nodes along the corridor (CMEA, 2011). Yet the Papuan corridor remains poorly scrutinised despite its significant regional implications, many of which have been critiqued locally (AwaMIFEE, 2013).

Papua's status as resource frontier poses distinct challenges to conservation and development along its corridor. Elsewhere in Indonesia, development corridors promote logging, mining, and estate agriculture generally across previously-exploited or settled landscapes, albeit with notable exceptions (Alamgir et al., 2018; Sloan et al., 2018a,b). Consequently, local management issues there are typically foremost, e.g., remnant forest integrity, endangered fauna mobility. Contrarily, in Papua the concerted penetration of remote, intact forests stirs *foundational* issues determining future regional conservation and development dynamics. Shifts in these dynamics are arguably setting Papua on the same course as other Indonesian regions of 20–30 years ago, but now in a more globalised context steeped in a national development agenda. Indeed, recent environmental trends in Papua recall the earlier frontier phases of other regions, e.g., exponentially increasing deforestation (Chitra et al., 2017) and a high and growing incidence of forest conversion within concessions (Abood et al., 2015; Austin et al., 2017).

3. Forest penetration, reactive management, and missed opportunities

Papua has struggled to address conservation and development challenges arising from its mega-projects (Kirsky, 2017). In rare instances, a resemblance with earlier mega-projects (Aldhous, 2004) has provided at least some anticipation of the likely scale of challenges. Yet with the ongoing penetration of Papua's remote regions, long subject to competing claims and civil conflict, relatively unexpected issues are also arising and outpacing reactive planning.

The globally-significant Lorentz World Heritage Site (WHS) illustrates such unexpected issues and reactive planning. Nearby forests were incorporated into the WHS prior to corridor construction through the WHS in 2012. This is considered best practice to prevent forest degradation from 'follow-on development' (Laurance et al., 2009). Still, in Papua even best practice may falter on weak foundations. Historically, local customary forest owners were indifferent towards the WHS designation, about which they were not consulted, and forest exploitation remained limited largely due to inaccessibility. Upon roading the vicinity, forest exploitation surged amongst customary owners and, importantly, non-local commercial loggers who negotiated access with customary owners. Ironically, rezoning the Lorentz WHS is once more being discussed, but now in relation to 'downgrading' existing degraded areas.

Such contested, reactive forest management will become more common as increased accessibility shifts the boundaries of land claims, resource extraction, and conservation. Papua greatly lags behind Indonesia in efforts to reconcile plans for development, conservation, land ownership, and land use. Reconciled plans, known as 'One Map', are scheduled for national publication by 2019; yet less than one-third of Papua's maps were 'synched' as of mid-2018, compared to > 80% in other regions (Jong, 2018). The recent legal recognition of customary forests[2] further complicates this difficult situation. Customary lands, a focus of Papua's separatist movement, are to be excised from the official forest estate, thus ceding control to traditional owners (Siscawati et al., 2017). However, of the 14 million hectares of customary forests under review nationally, only half have been 'registered' and virtually none of these are in Papua (BRWA, 2018). There is therefore an immense

[2] Constitutional Court Decision 35/2013.

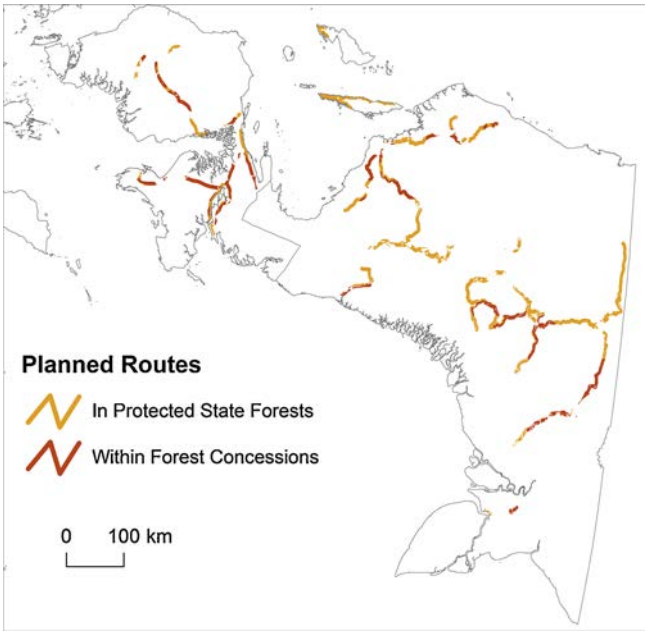

Fig. 2. Planned routes of the Trans-Papuan Corridor and associated roadways subject to customary land claims within protected state forests and forest concessions.
Notes: Planned routes are as per Fig. 1, buffered by 3 km. Forest cover presence is defined by the 2015 MODIS satellite image classification of Miettinen et al. (2016). Protected state forest is legally designated for conservation, protection, or permanent management. Forest concessions are with respect to estate agricultural plantations, wood fibre plantations, logging, or mining (GFW, 2018a, b, 2018c, 2018d).

reserve of Papuan land claims pending recognition within concessions and protected forests increasingly accessible via the corridor (Garnett et al., 2018; Sulistyawan et al., 2018) (Fig. 2).

Customary owners are unlikely await formal recognition before intensifying the exploitation of their lands, including in protected areas. Neither are local governments likely to refrain from issuing new concessions, including within unrecognised customary forests. The upshot is that the Papuan corridor is suddenly faced with uncertain scenarios that complicate conservation and development. Three outcomes are simultaneously foreseeable:

- The rapid pace of agro-industrial development limits the potential to resolve competing claims, 'locking in' grievances and unrest. Such is the case in south-eastern Papua, where communities have reactively mapped only small niches of legal recognition within an established agro-industrial landscape (Dewi, 2016; Sulistyawan et al., 2018). Elsewhere, instances in which corporations improved highway segments in exchange for logging rights (Colombijn, 2002) may preclude land claims entirely. Separatist sentiments may become inflamed should developments frustrate customary titles, which in turn could jeopardise private economic investments along the corridor network.
- Commercial loggers may operate increasingly through customary owners as the latter consolidate access to their forests. Such an outcome has been observed in Kalimantan following the recent implementation of community forestry (Resosudarmo et al., 2018, In Review). In Papua, this outcome is encouraged by the fact that most forest is precluded from new logging concessions by a national concession moratorium (Murdiyarso et al., 2011; Sloan, 2014). The lack of regulation for commercial logging on customary lands may aggravate strife and inequality amongst customary owners as well as between owners and the State.
- Investments along the corridor become mired by land claims, undermining the economic rational of the corridor. Such outcomes are common in neighbouring Papua New Guinea (Main and Fletcher, 2018). In Papua, stagnation is most likely to arise along an emerging deforestation frontier in the east (discussed below) and the central isthmus, given planned corridor construction and forests eligible for concessions.

4. Agro-industrial development and overlooked peatlands

Generic, centralised development approaches have struggled to recognise local priorities and ecological dynamics (Box 1). A case in point is the Merauke Integrated Food & Energy Estate (MIFEE) – a multi-million-hectare agricultural and biofuel megaproject comprising the south-western terminus of the Papuan corridor (Fig. 1). The MIFEE and associated infrastructure expansion were launched by Jakarta in 2010 (and re-energised in 2015) to increase national food and biofuel security (Indrawan et al., 2016; Yulisman, 2015). The mega-project occurs amongst the world's most extensive and mis-represented peatlands and has therefore highlighted conflict over development and conservation objectives.

Box 1
The unanticipated die-back of roadside forests

Papua is located within the Australasian biogeographical realm and thus in Indonesia it is uniquely host to *Nothofagus* forests (Knapp et al., 2005; Read and Hope, 1996; Swenson et al., 2001). This ancient genus is susceptible to the *Phytophthora cinnamomi* pathogen that may be linearly spread by road-construction, road traffic, logging, and the riverine transport of contaminated soils, particularly where soils are disturbed and drainage patterns altered (Newhook and Podger, 1972; Weste and Marks, 1987). Inexperience with this pathogen in Indonesia has allowed *P. cinnamomi* to establish itself recently along the Papuan corridor. Best practice for construction within *Nothofagus* forest entails regular disinfection of road-building machinery and soil aggregates to prevent *P. cinnamomi* spread (e.g. DCLM, 2003; Esso Highlands Ltd., 2009). No such measures were taken in Papua as *P. cinnamomi* was not assessed as a risk.

Nothofagus infestation and dieback are now observable within the Lorentz World Heritage Site (WHS) following corridor construction in 2012 (Fig. 3) (GOI, 2016b). Indonesian officials have asserted that the occurrence of the pathogen and related forest 'dieback' in the Lorentz WHS owes to climate change, with roads being an "aggravating factor" (UNESCO, 2017). This possibility remains unsubstantiated – Indonesian enquiries are ongoing – and regardless it discounts synergies between climatic stresses and pathogenic spread. Approximately 20% of the length of planned corridor routes would occur inside or adjacent to *Nothofagus* forest (Fig. 3), according to bio-climatic modelling (Supplementary Text). Uncertainty surrounding the conditions for pathogenic virulence (Read and Hope, 1996) and the role of road *proximity* (Wilson et al., 2008) would challenge attempts to plan routes to minimise the pathogen, which in any case would be limited by highland topography and the necessity of connecting existing roads. Experience suggests that *P. cinnamomi* virulence and spread are greater where forests are older, even-aged, and/or stressed (Read and Hope, 1996) and where soils are disturbed, nutrient poor, poorly drained, and/or subject to water transport (Newhook and Podger, 1972; Weste and Marks, 1987). Due to dieback and road building, UNESCO is considering re-designating the Lorentz WHS as a World Heritage Site 'in danger'.

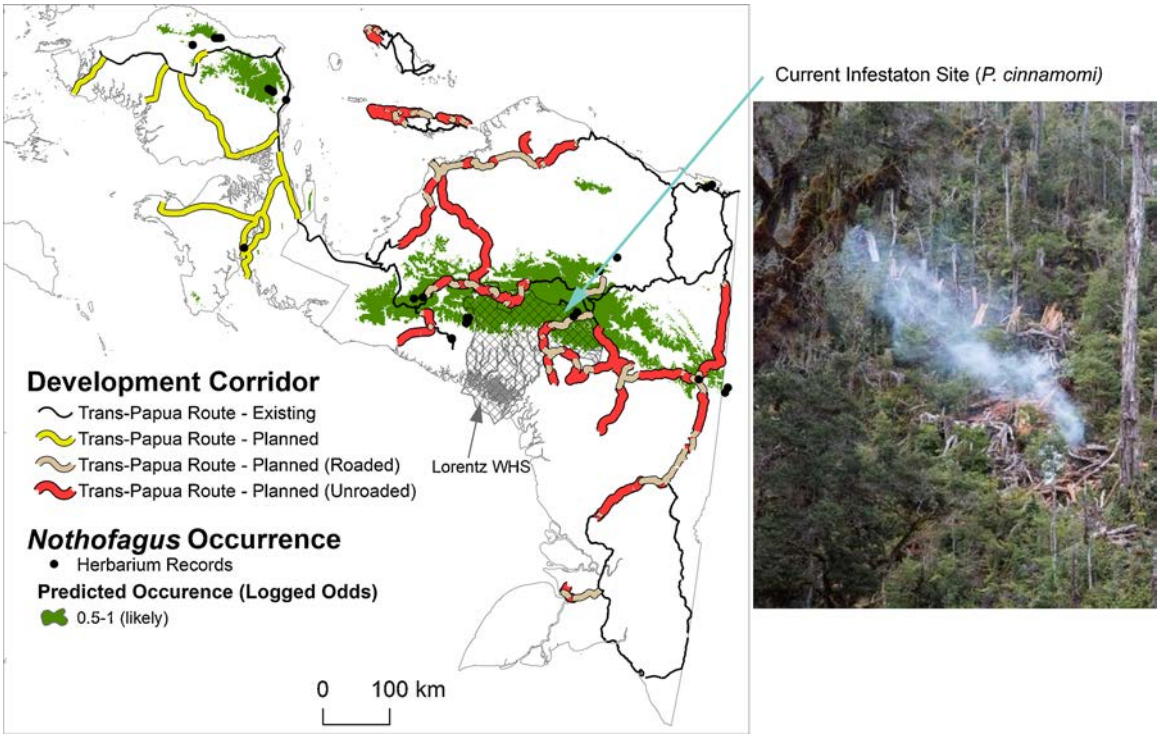

Fig. 3. The probability of *Nothofagus* forest occurrence in Papua (left) and the die-back of *Nothofagus* forest due to infestation by the *P. cinnamomi* fungus, Lorentz World Heritage Site (right).
Note: Photo taken April 2016. Infestation site is indicated in the left panel.

Developments within the MIFEE region jeopardise peatlands despite ambitious recent peatland protections. The national peatland extent was recently revised (BAPPENAS, 2013; Ritung et al., 2011; Wahyunto et al., 2014) to refocus the extent of strong new peatland protections (Warren et al., 2017:3). Consequently, the area of Papuan peatlands was reduced by 76% (4.4 Mha), in contrast to far lesser reductions elsewhere, due to the exclusion of extensive shallow peatlands (Warren et al., 2017). Thus, vast areas of probable peatlands in the MIFEE are subject to business-as-usual conversion along the corridor.

Across the MIFEE region, concessions for estate agriculture and pulp/timber plantations encompass at least 0.9 million ha of 'extra-official' peatlands (Fig. 4), defined as known and probable peatlands recognised by Jakarta but omitted from its revised peatland map. These 0.9 million ha and the concessions containing them are far more extensive than originally anticipated, as MIFEE concessions now greatly exceeded the 1.6 Mha 'development clusters' originally designated for development (Fig. 4) (AwaMIFEE, 2013). Concessions extend contiguously along the corridor, from the westernmost MIFEE development cluster to beyond the northern and eastern limits of recent MIFEE deforestation (Fig. 4 stars).

Peatlands revisions highlight a broader, implicitly political trend to reframe actual and potential land use (Goldstein, 2016). Officially, MIFEE developments target 'grasslands' or 'idle', 'degraded' and 'underused' frontier lands. Such areas are not explicitly recognised by development plans, affording considerable latitude for their interpretation. Indeed, many MIFEE agricultural concessions earmarked for development are 60–80% forest, including peat forest (Brockhaus et al., 2012). Recent MIFEE developments further evidence extensive deforestation (Fig. 4). In this light, it is notable that Papua Province had previously formulated a development plan recognising local uses of so-called 'idle' lands and restricting large-scale agro-developments such as the MIFEE (Suebu, 2009). Disagreement between this plan's 'alternative land uses' and Jakarta's generic forest licencing system ultimately promoted the latter over the former (Indrawan et al., 2016), facilitating losses of peatlands and forests.

5. Emerging epicentres of change

While new land-use dynamics are still unfolding, their location is becoming more apparent. New and old dynamics are converging along the corridor to define two potential frontiers of forest loss in the absence of countervailing activities.

In eastern Papua, a frontier is emerging where forests are (*i*) situated along pending corridor segments, (*ii*) eligible for legal exploitation, and (*iii*) near to intensifying conversion (Fig. 5; segments *e*, *f*, *h*, *i* Fig.1). In its north-eastern reaches, the frontier is fringed by smallholder agricultural conversion that has expanded significantly due to population growth and the release of forest for conversion (Zeng et al., 2018). In its south, it is bound by incursions from the MIFEE, which have pushed along the Trans-Papuan Highway beyond their original northern limit. MIFEE concessions now butt against older logging concessions, which span much of this frontier, defining a regional cluster of agro-industrial activity. Some ~300 km of new highway are planned across this juncture of agro-industrial and smallholder activity (Fig. 5) and would open the logging concessions to new pressures. These concessions are intact, notwithstanding swidden cultivation; but many are adjacent to agro-industrial conversion and/or occupied by agricultural communities. Such circumstances have frequently led to the degradation and conversion of logging concessions in other Indonesian frontiers (Barr, 2001; Sloan et al., 2018a,b).

In central Papua, another frontier is defined by mining concessions coincident with planned highway construction and nearby forest loss (Fig. 6; segments *a*, *b*, *c* Fig. 1). These concessions comprise part of an economic growth centre targeted by the corridor around a regional mining epicentre – one of the world's largest copper and gold mines (Fig. 6, Fig. 1). Although many mining concessions are in exploration stages, it is notable that 19 overlap 488 km^2 of the Lorentz WHS, with many in its interior (Fig. 6). These suggest that mineral extraction within the WHS is a possibility – one that might be both facilitated and complicated by ~211 km of highway planned across the Lorentz WHS and Enarotali Nature Reserve (Fig. 6; segments *a* and *b* Fig. 1). Mineral extraction within

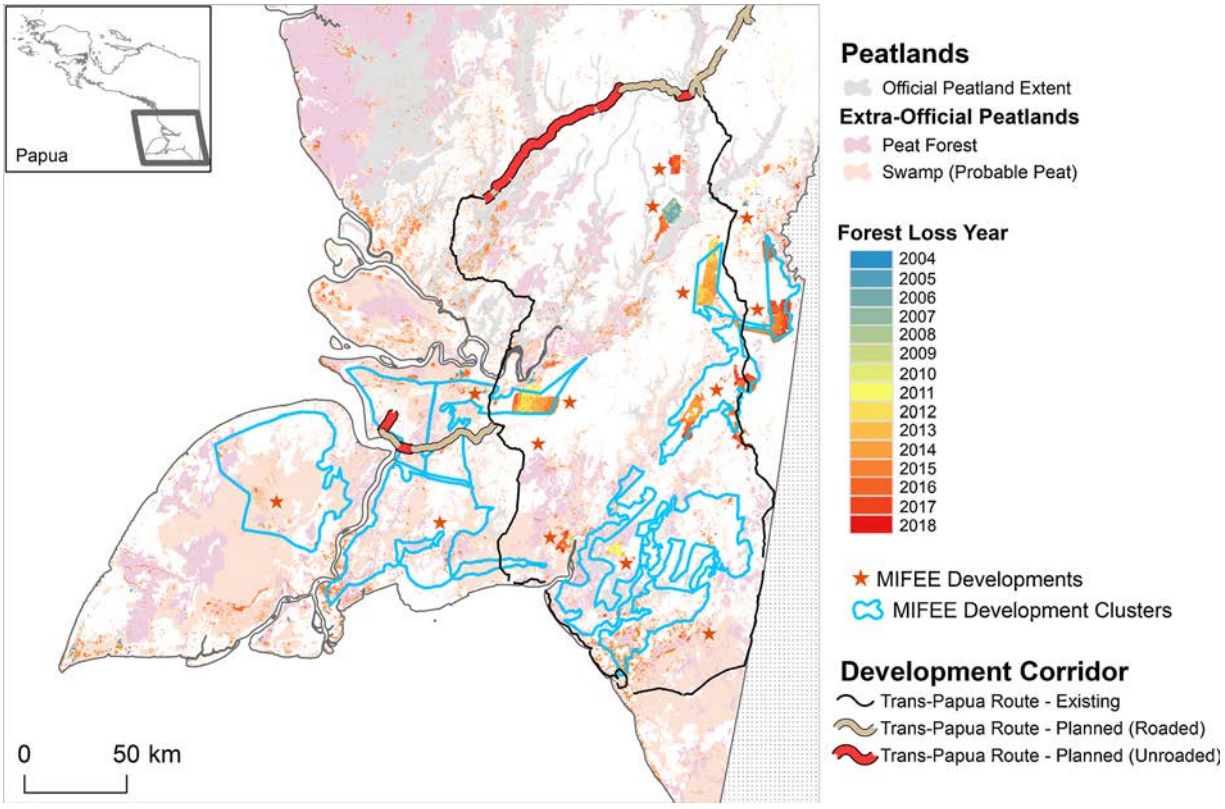

Fig. 4. Peatlands, recent deforestation, and MIFEE development clusters.
Notes: Extra-official peat forest and probable peatlands: Defined respectively by the peat swamp forests and swamplands classes mapped by the Ministry of Environment and Forestry (MoEF, 2015). They extensively overlap the independent, pre-revision extent of peatland previously used widely in Indonesia (Wahyunto and Subagjo, 2006) but were omitted from the revised official peatland extent (Ritung et al., 2011; Wahyunto et al., 2014). Forest losses by year: Compiled from automated deforestation alerts produced from weekly 30-m Landsat and daily 250-m MODIS satellite data (Hansen et al., 2016; Reymondin et al., 2012).

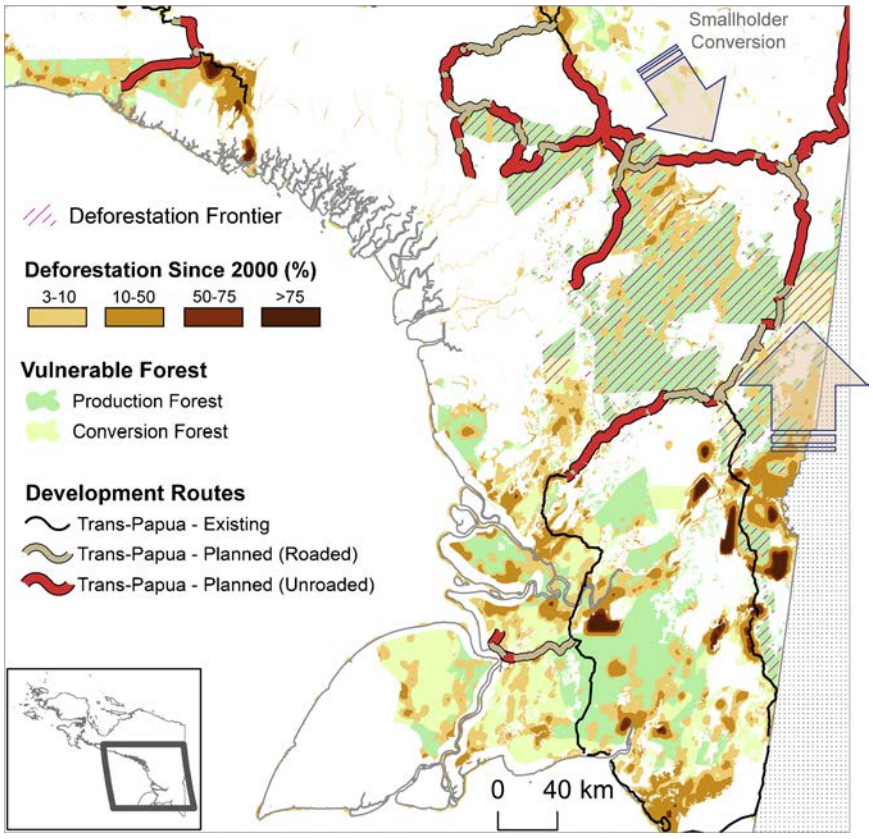

Fig. 5. Potential deforestation frontier: Agro-industrial expansion in Eastern Papua.
Notes: Vulnerable forest is exclusive of the moratorium area. Production forest is designated for logging but is occasionally degraded and converted illegally. Conversion forest is designated for agriculture. Deforestation spans 2000–2017 according to (*a*) updated (v. 1.5) annual 30-m Landsat classifications of Hansen et al. (2013) and automated deforestation alerts produced from (*b*) weekly 30-m Landsat and (*c*) daily 250-m MODIS satellite data (Hansen et al., 2016; Reymondin et al., 2012). Data were re-sampled to 100-m for processing. Deforestation rate refers to the percentage area deforested since 2000 within a 3-km radius of a pixel.

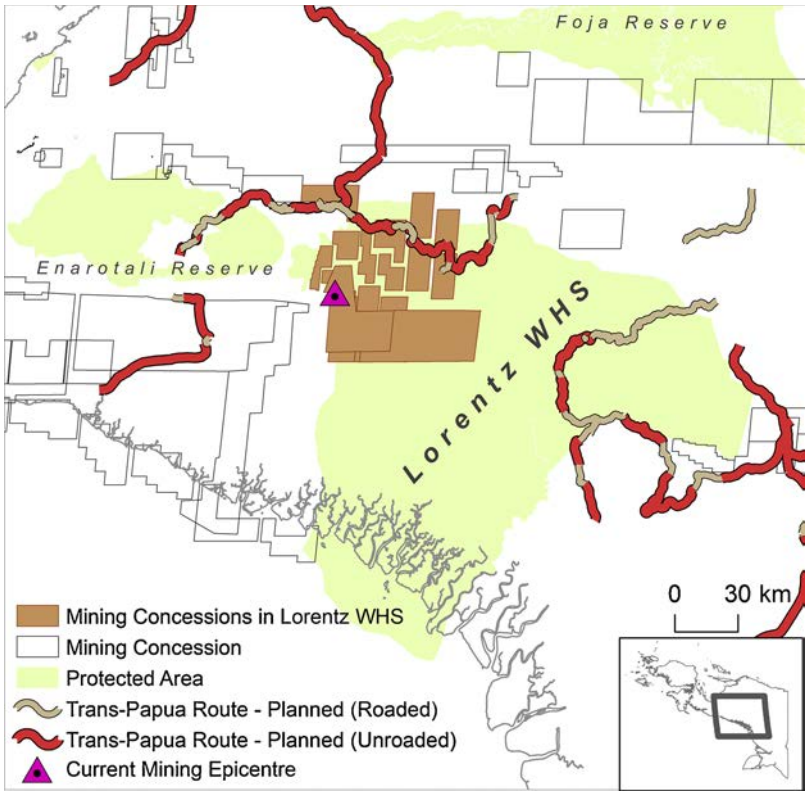

Fig. 6. Potential deforestation frontier: Mineral extraction in and around the Lorentz World Heritage Site.
Notes: Current mining epicentre is the Grassberg gold and copper mine. Trans-Papua Corridor routes are as described for Fig. 1. Planned routes that are 'roaded' run along areas already having roads of some form, whereas planned routes that are 'unroaded' appear to lack roads and be forested according to high-resolution satellite imagery of ca. 2016.

Table 1
Examples of protected area downgrading, downsizing, or degazettement (PADDD) in Indonesia.
Source: PADDD database of WWF and CI (www.padddtracker.org; accessed August 2018).

Protected Area	Event	Cause	Event Year	Area Affected (km^2)
Tanjung Putting National Park	Downsized	Industrial Agriculture	2013	358
Batang Gadis National Park	Downsized	Mining	2012	385
Kerinci-Seblat National Park	Downgraded	Infrastructure	2011	Unreported
Muara Kendawangan Nature Reserve	Downsized	Unreported	1993	260
Halimun-Salak National Park	Downsized	Land Claim	1992	2.5
Kerinci-Seblat National Park	Downsized	Infrastructure	1992	2531
Pleihari Tanah Laut Reserve	Degazetted	Industrial Agriculture	1992	60
Berbak Wildlife Sanctuary	Downsized	Unreported	1990	731
Kerinci-Seblat National Park	Downsized	Forestry	1990	Unreported
Kutai National Park	Downsized	Industrialisation	1990	14
Kerinci-Seblat National Park	Downsized	Industrial Agriculture	1985	Unreported
Kutai National Park	Downsized	Forestry	1971	1060
Berbak Game Reserve	Downsized	Industrial Agriculture	1965	Unreported

Indonesian protected areas is not without precedent. In 2012, for example, Indonesia reduced Batang Gadis national park in Sumatra by 385 km^2 to allow mining, and many other protected areas have been similarly downsized, downgraded or degazetted to accommodate oil palm, logging, and road building (Table 1).

5.1. The costs and benefits of pending developments

Planned corridor segments in these two frontiers and the MIFEE region have uneasy relationships with the rational for the Papuan corridor. Publicly, the rational is divided, referring sometimes to a nation-building integration of disconnected population centres, and other times to a poverty-alleviating promotion of agriculture, forestry, and mining (Fig. 1). Privately, ongoing investments of $1.4 billion by the central government (Jakarta Post, 2017) has led some to speculate at a nationalistic consolidation of 'peripheral' ethnicities. Weighing the monetary and environmental costs of the planned segments against their anticipated benefits is therefore challenging.

Corridor completion in the central and eastern frontiers would address nation building by connecting isolated highland regional centres of Papua Province with the provincial capital of Jayapura on the north coast, Merauke township on the south coast, and regional centres in Papua Barat Province. In contrast, the $312 million estimated construction cost[3] (for the corresponding segments *a*, *b*, *e*, *f* and *i* in Fig. 1) may attract limited agro-industrial economic growth, contrary to central-government plans (CMEA, 2011), as mining and forestry there were already possible. For the central frontier, the cost-benefit ratio of its planned corridors could be much improved simply by nullifying the mining permits within the Lorentz WHS. The benefit of the adjacent

[3] Costs were calculated for planned highway segments (Fig. 1) based on per-kilometre cost estimates provided by the Papuan Regional Body for Planning and Development (BAPPEDA). Costs encompass road design, drainage, drainage, and surfacing.

planned Tigi-Meer Lake–Mimika District segment *c* (Fig. 1) is more dubious. For its estimated $21 million construction cost and penetration of intact, largely unpopulated forests and peatlands in the coastal Mimika District, the most likely outcome is remote oil-palm plantations, given recent oil-palm establishment just west of this segment near Timika township. Greater access to mining exploration permits of unproven resources would also result (Fig. 6). Such benefits are tenuously aligned with the rationales for the corridor.

The completion of corridor segments *j* in Mappi and Boven Digoel Districts and *k* in Merauke District (Fig. 1) would similarly yield uncertain and probably meagre benefits for the MIFEE region. Limited regional integration would result from the Mappi-Boven Digoel segment *j* given the few small villages along its route and the availability of alternative roadways for many of these (Fig. 1). Neither could significant agro-industrial growth be confidently anticipated. Agro-industrial activities along existing corridor segments in the MIFEE region have been less productive and patchier than planned due to swampy conditions. Such are the circumstances that some concessionaires are contemplating abandoning their investments (BAPPEDA Papua, pers. comm. 2018). Consequently, Papuan officials are discussing the revision of the MIFEE into a more conservative, confined venture promoting low-emission activities like sago plantations. In light of the peatland emissions and estimated $38 million construction cost associated with these planned Mappi-Boven Digoel and Merauke segments, these segments should be reconsidered only once the fate of the MIFEE is clearer.

6. Discussion

Papua is at a crossroads of conservation and development as new dynamics consolidate around its extensive economic corridor (Kusumaryati, 2017). Uncertainty surrounding forest rights and usage, the loss of peatlands, and the emergence of deforestation frontiers characterise a national development agenda that has displaced regional priorities and caught local administrations poorly prepared. In this light, we offer recommendations to strengthen conservation and development planning along the corridor.

6.1. Peatlands

Poorly-controlled peatland conversion is contrary to both increased peatland protections and national carbon emission-reduction goals. Carbon emissions from burning MIFEE peatlands during the 2015 El Niño echo the significant emissions from peatland fires in the centrally-planned Mega-Rice project of Kalimantan (Aldhous, 2004; Page et al., 2002; Rieley and Page, 2008).

The extent of peatland and thus of peatland conservation should be immediately re-assessed across south-eastern Papua. The national peatland revision was simplistic and lacked field data (BAPPENAS, 2013), which where available suggested that Papuan peatlands were *more* extensive than estimated (BAPPENAS, 2013; Jaenicke et al., 2008). In a perverse twist, recent national legislation identified at least 158,000 ha in Papua that may in future host logging and timber plantation concessions translocated from elsewhere in Indonesia in the name of peatland protection[4] (Jong, 2018; MoEF, 2017). Virtually all such areas in Papua are intact production forests eligible for exploitation within the MIFFEE region (Fig. 5), where peatlands are defined with relative uncertainty. The development of Papuan translocation sites would therefore entail possible extra-official peatland degradation and certain intact-forest conversion within the eastern deforestation frontier. Criteria for the final selection of translation sites remains poorly known.

[4] Legislation P.17 and P.40 of 2017 of The Ministry of Environment and Forestry. Maps of potential translocation areas are described by Jong (2018) and available here: https://drive.google.com/drive/folders/0B0WeKk7HPvj7VEoyOHVOUUtWZ3M

The re-assessment of Papuan peatlands should be facilitated by the recently announced national initiative to remap Indonesian peatlands (WRI, 2018), which should commence in Papua. The re-assessment may fail to alter Papuan dynamics in the likely event that Jakarta is slow to integrate the new peat map. District-level officials may still revise concession applications according to interim maps. Such revisions would be unlikely in the absence of a provincial gubernatorial mandate, much like the logging ban in Aceh Province (Linkie et al., 2014). Such a mandate could re-align Papua with its earlier low-carbon development plan and support Indonesia's international commitments to reduce its greenhouse gas emissions by 29–41% by 2030, considering that 63% of emissions stem from forestry and land use (GOI, 2016a).

6.2. Customary land claims

Agro-industrial developments in eastern Papua have been characterised as 'land grabs' (Dewi, 2016; Ginting and Pye, 2011; Goldstein, 2016). These reflect not only foreign investment and extensive land titling but also Jakarta's land-tenure regime that rationalised the use of 'idle lands'. Papuan customary communities have consequently been overlooked in this realm despite strong legal recognitions otherwise. There remains significant potential for continued development to preclude customary land rights and associated economic opportunities for communities.

An enhanced, pre-emptive mechanism for addressing customary claims along the corridor is a key priority. Although mechanisms exist to incorporate Papua's customary communities within the official land-tenure regime, the process is exceptionally onerous for communities (e.g., Sulistyawan et al., 2018). A dedicated technical / administrative team is required, often provided by a NGO, for which reason Papua's customary land claims are drastically under-represented relative to Indonesian regions where NGOs are more active (BRWA, 2018).

A mechanism by which concession proponents can identify and register local customary claims in collaboration with stakeholders would address this issue. Such a mechanism also makes good business sense, as it would preclude many conflicts that beset Papuan concessions. It is, however, likely that proponents will baulk at the prospect of soliciting and registering customary claims within prospective concessions. District-level regents are arguably similarly unlikely to discourage local investment with such a mechanism. Mandates from provincial governorers as well as economic support would therefore again be required.

6.3. Mining in protected areas

Mining in the Lorentz WHS is arguably the most alarming possibility raised by the Papuan corridor. Such an outcome would parallel disturbing global trends – 38% of WHS are overlapped by mining, oil, and gas concessions (WWF, 2015). Although some of this overlap is probably due to imprecise concession boundaries, this is not the case for the Lorentz WHS, which hosts numerous concessions adjacent to a major mine and the Trans-Papuan Corridor intended to bolster extraction. The fact that the Lorentz WHS has exceptional natural values – ranked 13th amongst > 173,000 protected areas in terms of the uniqueness and vulnerability of its fauna (Le Saout et al., 2013) – underscores the significance of any environmental degradation that mining and associated road infrastructure would cause. The presence of these concessions undermines confidence that the WHS will remain intact. These concessions should be nullified in the interests of unambiguous conservation management.

7. Conclusion

Conservation and development in Papua are poised to shift dramatically with the development of the Trans-Papua Corridor. Regional plans that might address ensuing environmental and social dynamics

remain reactive, rather than proactive. Some corridor segments have dubious merit and should be reconsidered, while others may be managed with improved planning, particularly that focusing on peatland conservation and customary-land exploitation. Provincial-level political interventions are urgently required until more robust policies can be put in place.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.envsci.2018.11.011.

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