

Forest Loss from Oil Activities: A Matter of Democracy

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By 2010, 17% of all global onshore oil and gas exploration wells had been drilled in forests. In the vicinity of such wells, the rate of forest loss after drilling is twice as high in undemocratic countries as in democratic countries (73% versus 35% of the forest is lost over a period of ten years). We find no evidence of less forest loss around wells operated by firms with supposedly strong corporate governance, underlining the determining role of political governance.

New studies have suggested that the world's forests could be under threat from fossil fuel and minerals extraction (1, 2). These developments are particularly worrying for tropical forests, as they have high bio-diversity, play important roles as carbon sinks, and are often located in countries with political institutions less able to protect the forests (2). The threat to these forests would grow further if the global oil industry shifted its historical focus from exploration and extraction in countries with strong institutions (3) to countries with weaker institutions, as a

recent study argues has already begun to happen (4).

The Obama administration's rejection of the Keystone XL pipeline in the U.S. exemplifies the role strong democratic institutions can play in limiting the environmental impacts of oil activities. The rejection was preceded by pressure from activists and politicians in Congress (5). In contrast, Peru has been criticized for paying too little attention to its indigenous people and the local environment during expansions of its oil exploration (6, 7), while Indonesia has grabbed international headlines due to alleged corruption in a project seeking to clean up toxic substances around wells drilled by Chevron (8, 9).

Our analysis provides, to the best of our knowledge, the first global evidence on the roles of democracy and company characteristics for the impacts of oil activities on the local environment. The sample covers forest loss in the period 2001-2013 near 3331 oil and gas (hereafter "oil") exploration wells drilled in forest in the period 2004-2010. The wells are drilled in 62 different countries, spanning the entire spectrum of different democracy scores. We first estimate that the wells are associated with forest loss. This has previously been shown only for the U.S. and Canada (1). We then show that the forest loss related to oil activities is much higher in undemocratic countries than in democratic countries. Finally, we find no evidence that companies from democratic countries, or companies with other characteristics believed to be associated with high standards of corporate governance, operate wells with systematically lower forest loss. Our findings point to the central role of political governance in reducing local environmental hazards from fossil fuel extraction.

Oil activities and forest loss. Ecosystem functions including wildlife habitat, bio-diversity and landscape connectivity are threatened by oil activities (1, 10–12). In the preparation of new locations for oil drilling, areas of forest often have to be cleared. Clearance may initially be driven by the space required for drilling equipment as well as the construction of access roads

and accommodation. In the event of a commercial discovery, the project may transition from exploration to development, attracting increased investments and construction of the facilities and infrastructure required. Where exploration activities open up previously inaccessible regions, they may also create opportunities for others to engage in economic activities that lead to further clearance, such as commercial as well as illegal logging. All these activities may also lead to local pollution, such as spillage of chemicals. Earlier work has estimated a considerable environmental footprint from oil and gas drilling in central Canada and the U.S., due to well pads, roads, and storage facilities (1). An emerging literature discusses similar local environmental effects of shale gas developments in the U.S. (13).

The role of democracy. For developing countries, there is a difficult trade-off between opening up new areas for oil activities that might drive increased economic growth on the one hand, and risking severe environmental impacts on the other. The property rights to sub-soil resources and associated revenues are entrusted to the state in most countries, whereas negative environmental impacts are felt by local communities and the global community. Political institutions are key in balancing the different concerns and supporting conditions for environmental safeguards. There is an abundance of anecdotes related to mineral and fossil fuel extraction where environmental concerns have formed a key part of local communities demands and influence over company and government behavior (14). However, such influence requires political rights and accountability mechanisms. One study pointed to the importance of weak governance in exacerbating deforestation in Indonesia, by allowing local politicians and bureaucrats to extract rents related to deforestation instead of preserving the forest (15). In countries at the other end of the democratic spectrum, companies are required to restore the local environment and engage in conservation activities. In Canada, where Environmental Impact Assessments (EIAs) are mandatory to ensure active mitigation plans are pursued, oil companies have engaged in

reforestation programs where more than 12 million trees have been planted (16).

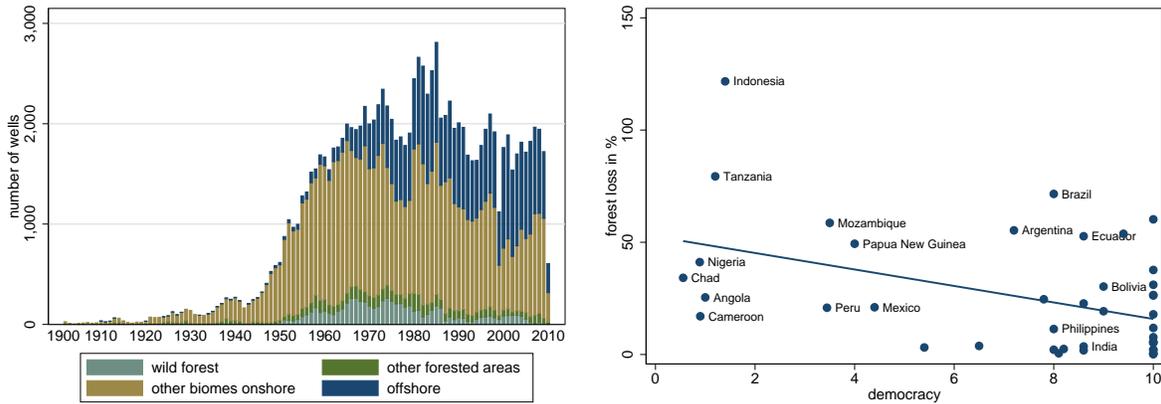


Figure 1: Oil drilling over time and forest loss vs. democracy scores

Notes: The left hand panel shows oil exploration across four “biomes” since 1900. Right hand panel illustrates the main finding of this paper: countries with high democracy scores have lower accumulated forest loss around their oil wells than do countries with low democracy scores. The figure presents the negative association between the quality of democracy and accumulated forest loss in the period 2000-2012. The former is calculated as a mean over the 1990s and the latter is calculated as the mean across all wells per country. Figure excludes countries with zero forest loss. Sources: (17) and (18).

Oil exploration in forested areas. Figure 1, left hand panel, shows the frequency of exploration drilling for petroleum resources, split between drilling in wild forests, in other types of forests, in remaining onshore biomes, and offshore. From 1950 onwards, the global count of wells increases considerably in our dataset. There was a wave of forest drilling from the 1960s through to the 1980s, while forest drilling was comparatively low in the 1990s and 2000s. This may change in the future, as many unexplored areas are in forests (2). By 2010, 17% of all onshore wells lie in forested areas in our data, whereas 31% of the landmass on the globe was forested in 2013 (19). Some forested areas have seen much exploration, e.g. the western Amazon Basin, a region that is known to be exceptionally biologically rich [see supplementary materials (SM)]. The right hand panel of figure 1 illustrates the main finding of this paper: undemocratic countries have higher forest loss around their wells, and democratic countries have

lower forest loss around their wells.

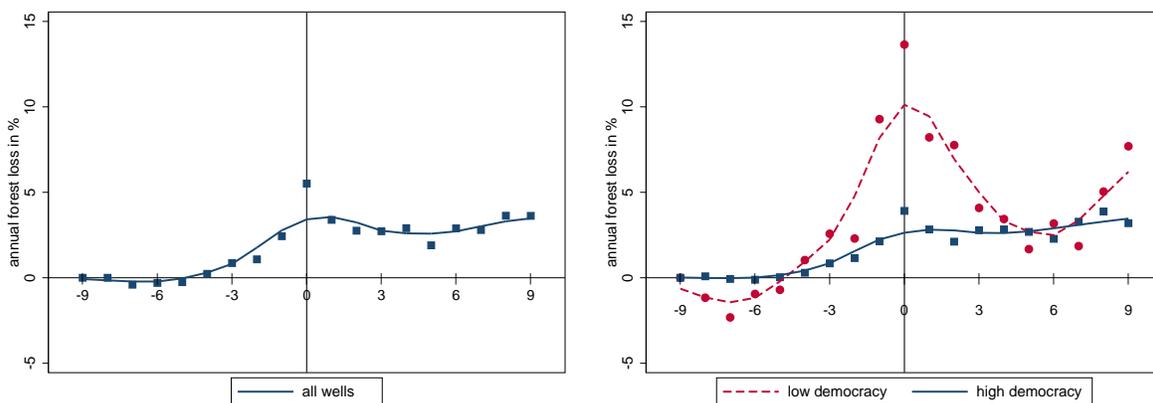


Figure 2: Forest loss before and after exploration drilling

Notes: Oil exploration drilling and associated forest loss before and after drilling. Annual forest loss is measured in percent of a 1 sq km zone surrounding exploration wells. The starting year of exploration drilling is set to $t=0$. “low democracy” refers to countries with a Polity IV democracy score of 0-5, “high democracy” refers to countries with a Polity IV democracy score of 6-10.

Forest loss at exploration wells. Figure 2 displays the forest loss in the immediate 1 sq km vicinity of exploration wells, covering nine years before and nine years after the drilling year. The left hand panel is for all wells, which have an average forest loss of 4.1% per year after drilling, summing up to 41.4% over ten years (SM). The right hand panel shows that the forest loss is much higher in host countries with low democracy scores (such as Angola, Mexico and Mozambique) than in host countries with high democracy scores (such as Australia, Brazil and Chile; see SM for details).

In both panels, the pattern of forest loss is consistent with clearance in preparation for exploration drilling, removal of forest related to the drilling itself, and high annual forest loss in the years after a well is drilled due to increased activities in the area. In undemocratic countries, there is also additional forest loss most likely related to extraction of oil, as (20) find it takes on average about five years after discovery for extraction to start.

Oil discoveries as natural experiment. In our set-up, wells with and without discoveries should hold the same *ex ante* likelihood of striking oil (SM). By comparing forest loss around discovery wells and non-discovery wells, we estimate the causal effect of oil discovery on forest loss. 68% of the exploration wells in our data lead to a discovery of oil, without any systematic differences with respect to democracy scores (SM).

For a country with a low democracy score like Angola's, we estimate that a non-discovery well is associated with 24.2% forest loss in the 1 sq km vicinity, whereas a discovery well leads to an additional 48.5 percentage points of forest loss, or 72.7% all together. In a country with a high democracy score like Canada's, a discovery actually leads to lower forest loss than a non-discovery, 35.3% versus 47.0%. A potential explanation for this result is restoration and conservation efforts undertaken by operating companies, such as those reported by Canada's Oil Sands Innovation Alliance (21).

Company types. Pressure from shareholders, customers and opinion makers may affect how much a company seeks to protect the environment in the course of its activities. We investigate a list of company characteristics, such as the democracy level in their country of origin, public listing on a stock exchange and status as a supermajor international oil company (the seven IOCs are: BP, Shell, Chevron, ExxonMobil, Total, Eni and ConocoPhillips). We reject that such characteristics are systematically associated with different impacts of oil discovery on forest loss across the wells in our sample (SM). We also find that these company characteristics on average do not alter the influence of host-country democracy. These findings have two, equally valid, interpretations: i) presumptively "responsible" companies appear to behave no differently than other companies or ii) the circumstances related to weak democratic institutions in the drilling-locations are hard to overcome even for presumptively "responsible" companies.

Looking forwards Our results point to the importance of democracy in limiting the environmental footprint of resource extraction in forests. The large variation in democracy scores across countries reflects varying degrees of constraints on the executive branch of government, political competition, freedom of speech and accountability of decision making. Citizens and organizations in democracies may be better able to voice environmental concerns and prompt the introduction and enforcement of policies to protect the environment. Our results are in line with a large economics literature that have found well-functioning and inclusive political institutions to be critical for economic development (22).

A surprising result in our study is that the forest loss in the wake of an oil discovery on average does not depend on which company is in charge of the operation. Companies with aspirations to minimize their impact on the local environment may need to work harder to overcome the poor historic record of forest loss that we estimate in countries with weak political institutions.

To date, the world may have been spared some of the more excessive environmental damages associated with the extraction of fossil fuels, as the oil sector has been most active in countries with high democracy scores (3). In the future, the focus of investors may shift and more oil extraction could take place in forests and in developing countries with lower democracy scores (4). Our findings imply that this would lead to more local damages and also raise the implied carbon content of a typical barrel of oil. The flip side of our finding, however, is that governments can take on a determining role as mediators between firms and the forest, with the upshot that huge forest loss from oil activities is not inevitable.

References and Notes

1. Brady W. Allred, W. Kolby Smith, Dirac Twidwell, Julia H. Haggerty, Steven W. Running, David E. Naugle, and Samuel D. Fuhlendorf. Ecosystem services lost to oil and gas in north america. *Science*, 348(6233):401–402, 2015.
2. N. Butt, H. L. Beyer, J. R. Bennett, D. Biggs, R. Maggini, M. Mills, A. R. Renwick, L. M. Seabrook, and H. P. Possingham. Biodiversity risks from fossil fuel extraction. *Science*, 342(6157):425–426, 2013.
3. James Cust and Torfinn Harding. Institutions and the Location of Oil Exploration. *OxCarre Research Paper*, 127, December 2013.
4. Rabah Arezki, Frederick van der Ploeg, and Frederik Toscani. A move south. *Finance & Development*, 53(1), 2016.
5. Time Magazine, President Obama Announces Rejection of Keystone XL Pipeline. President obama announces rejection of keystone xl pipeline. Nov 6th, 2015.
6. The Economist, Oil and gas in Peru—A warm welcome. Oil and gas in peru, a warm welcome. Apr 10th, 2008.
7. Matt Finan, Clinton N. Jenkins, and Bill Powers. Potential of best practice to reduce impacts from oil and gas projects in the amazon. *PLoS ONE*, 8(5):1–14, 05 2013.
8. Financial Times, Chevron staff arrested in Indonesia. Chevron staff arrested in indonesia. Sep 27th, 2012.
9. The Wall Street Journal, Murray Hiebert, Indonesias Skewed Case Against Chevron. Indonesias skewed case against chevron. Nov 5th, 2014.

10. Matt Finer, Clinton N. Jenkins, Stuart L. Pimm, Brian Keane, and Carl Ross. Oil and gas projects in the western amazon: Threats to wilderness, biodiversity, and indigenous peoples. *PLoS ONE*, 3(8), 2008.
11. Matt Finer and Mart Orta-Martnez. A second hydrocarbon boom threatens the peruvian amazon: trends, projections, and policy implications. *Environmental Research Letters*, 5(1):014012, 2010.
12. Rebecca C. Rooney, Suzanne E. Bayley, and David W. Schindler. Oil sands mining and reclamation cause massive loss of peatland and stored carbon. *Proceedings of the National Academy of Sciences*, 109(13):4933–4937, 2012.
13. Lucija Muehlenbachs, Elisheba Spiller, and Christopher Timmins. The housing market impacts of shale gas development. *American Economic Review*, 105(12):3633–59, December 2015.
14. The Economist, Mining in Latin America: From conflict to co-operation. Mining in latin america: From conflict to co-operation. Feb 6th, 2016.
15. Robin Burgess, Matthew Hansen, Benjamin A. Olken, Peter Potapov, and Stefanie Sieber. The political economy of deforestation in the tropics*. *The Quarterly Journal of Economics*, 127(4):1707–1754, 2012.
16. Cesar A. Poveda. The canadian oil sands development: Management of land, air and water resources. *European Journal of Sustainable Development*, 4(2):359–368, 2015.
17. Wood Mackenzie. Pathfinder database, exploration wells dataset, accessed 10 10 2011. 2011. Wood Mackenzie’s PathFinder is a commercially-available database, updated quarterly, that contains worldwide exploration and production data for the petroleum industry.

18. The Polity IV Project, Center for Systemic Peace. Polity iv annual time-series, 1800-2014. retrieved from <http://www.systemicpeace.org/inscrdata.html>, 2016.
19. Food and Agriculture Organization. Forest area (% of land area). 2016. <http://data.worldbank.org/indicator/AG.LND.FRST.ZS>.
20. Rabah Arezki, Valerie A. Ramey, and Liugang Sheng. News shocks in open economies: Evidence from giant oil discoveries. *Quarterly Journal of Economics*.
21. COSIA. Land. 2016. <http://www.cosia.ca/initiatives/land>.
22. Daron Acemoglu, Simon Johnson, and James A. Robinson. Institutions as a fundamental cause of long-run growth. In Philippe Aghion and Steven Durlauf, editors, *Handbook of Economic Growth*. Elsevier, 2005.

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All three authors designed the research, discussed the results and implications, and wrote the manuscript. J.C. and H.K. prepared the data and H.K. ran the empirical analysis, including the preparation of figures and tables. T.H. supervised the empirical analysis and the writing. All three authors contributed equally to this work.