The Clean Paper

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Mining tana share fiye da mine kanta — hidden forest loss a kewaye da extraction

Wani Nature study na mine clusters 16,627 a sub-Saharan Africa ya gano mining a dense forests ta haifar da kusan hectares 187,000 na direct deforestation daga 2001 zuwa 2020, amma larger story offsite ne. Bayan shekaru goma, deforestation within 1 km ta kasance maki 8 sama a 0–100 scale fiye da unmined areas, effects kuma har 20 km. A five-year calculation, kowane hectare da mine ta clear directly ya associate da 33.9 additional hectares offsite. Wannan ba ya nufin energy transition bad ne; yana nufin mineral supply chains suna da geography da forest costs fiye da pit.

Written by Laura Nesso · Cross-checked by Lucio Vaglio · Edited by Michele Renda · Figures by Laura Nesso and Nova Vela · AI-assisted, human-reviewed

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Tasirin ma’adinai bai tsaya ga ramin da ke cikin daji ba

Ma’adinai suna da siffar da ake iya gani: rami, tafkin tarkace, tudun ƙasa da aka tono, ko hanya da ta yanke cikin daji. Waɗannan su ne alamomin da tauraron dan adam zai iya gani kuma mai kula da dokoki zai iya kewaye su da iyaka.

Amma hakar ma’adinai tana canza ƙasar da ke kewaye da ita ma. Mutane suna ƙaura zuwa wurin. Hanyoyi suna sauƙaƙa shiga daji. Kauyuka da garuruwa suna faɗaɗa. Noma yana ƙaruwa. Ma’adini ba tabo ne kawai a taswira ba; zai iya zama sabon cibiyar da ayyukan mutane ke taruwa a kanta.

Wata takarda a *Nature* ta ƙididdige wannan bambanci a ƙasashen Afirka kudu da Sahara. Marubutan sun kiyasta sare dazuzzuka da hakar ma’adinai ta haifar kai tsaye a dazuzzuka masu kauri daga 2001 zuwa 2020, sannan suka tambayi nawa ne ƙarin asarar daji da ke faruwa a kusa da ma’adinai idan aka kwatanta da wurare makamanta waɗanda ba a fara hakar ma’adinai a cikinsu ba. Sakamakonsu mai sauƙi ne amma ba dadi: **filin ma’adinin da ake gani shi ne kawai ɓangaren asarar.**

Hoton Landsat mai launukan dabi’a yana nuna manyan guraben hakar zinariya da na masu aikin hannu a yankin zinariya na Ashanti a Ghana. Binciken da ake tattaunawa a nan ya tambayi nisan da asarar dajin da ke da alaƙa da hakar ma’adinai ke kaiwa bayan iyakar ma’adinin kansa.

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Wannan sakamako yana da amfani ga muhawarar yanayi da bambancin halittu, domin yana riƙe gaskiyoyi biyu a lokaci guda. Ababen more rayuwa na zamani da sauyin makamashi suna buƙatar ma’adanai. Amma ma’adanai ba sa fitowa daga babu. Tambayar da ta dace ba “hakar ma’adinai tana da kyau ko tana da muni?” ba ce. Ita ce: **ana auna cikakken kuɗin da daji ke biya da gaskiya kuwa?**

Abin da marubutan suka yi

Binciken ya haɗa bayanan daji da amfani da ƙasa na faɗin nahiyar da wata hanyar lissafi da aka tsara don kusantar dalili da sakamako. Marubutan sun taswira **rukunin ma'adinai 16,627** a yankunan daji na Afirka kudu da Sahara tsakanin 2001 da 2020. Sun raba asarar daji gida biyu.

Na farko shi ne **sare daji kai tsaye saboda hakar ma'adinai**: share daji a cikin filin ma'adinin kansa, ciki har da ramuka, tafkunan tailings, tudun tarkace, shafts da sauran abubuwan da suke da alaƙa kai tsaye da aikin hakar.

Na biyu shi ne **sare daji a wajen filin ma'adinin**: asarar daji a kewayen ma'adinin wadda ba ramin ma'adinin kanta ba ce, amma kafa ma'adinin na iya tayar da ita ta hanyar ayyukan da suka biyo baya — noma, matsugunai, hanyoyi da sauran hanyoyin shiga.

Don kiyasta wannan ɓangare na biyu, marubutan sun yi amfani da tsarin **difference-in-differences**. A saukaƙe, sun kwatanta asarar daji a kusa da ma'adinai kafin da bayan an fara hakar da asarar daji a wurare makamanta waɗanda har yanzu ba a fara hakar su ba. Sannan suka duba zobe-zoben nisa daga tsakiyar ma'adinin: cikin kilomita 1, 1–5 km, 5–10 km da 10–20 km.

Wannan hanyar tana da muhimmanci domin takardar ba kawai tana ƙirga bishiyoyin da suka ɓace kusa da ma'adini ba. Tana ƙoƙarin kiyasta **ƙarin** asarar da za a danganta da kafa ma'adinin idan aka kwatanta da abin da zai yiwu ya faru a wurin da ba a haƙa ba.

Abin da suka gano

Asarar kai tsaye saboda ma'adinai ta yi yawa. A dazuzzuka masu kauri na Afirka kudu da Sahara, marubutan sun kiyasta **hectare 187,070** na sare daji kai tsaye saboda hakar ma'adinai tsakanin 2001 da 2020. Jamhuriyar Dimokuraɗiyyar Kongo, Ghana da Côte d'Ivoire tare sun kai **45%** na wannan asarar kai tsaye.

Asarar da ke kewaye da ma'adinin ta fi filin ma'adinin kansa girma. Shekaru goma bayan kafa ma'adini, sare daji a cikin kilomita 1 ya kasance **maki 8 mafi girma a ma'aunin 0 zuwa 100** idan aka kwatanta da wuraren da ba a haƙa ba. Wannan bambanci ne kai tsaye a yawan sare daji, ba ƙarin 8% na dangi ba. Tasirin ya ragu da nisa amma bai ɓace ba: bayan shekaru goma, ƙarin bambancin da binciken ya kiyasta ya kai maki 3.6 a 1–5 km, 1.9 a 5–10 km, da 1.1 a 10–20 km.

Waɗannan lambobi na wani takamaiman lokaci ne: tasirin bayan **shekaru goma** ne, ba asarar da ta faru nan take ba.

Rabonsa tsakanin asarar wajen ma'adini da ta cikin ma'adini ya yi matuƙar girma. A wani lissafi dabam, marubutan sun kiyasta cewa ga kowane hectare ɗaya da aka sare kai tsaye saboda filin ma'adini, an rasa a matsakaici **hectare 33.9** na ƙarin daji mai kauri a wajen ma'adinin cikin shekaru biyar. Mafi yawan wannan ƙarin asarar an danganta ta da faɗaɗa noma bayan kafa ma'adini; faɗaɗar matsugunai ma ta taka rawa, yayin da hanyoyi suka zama ƙaramin kaso a rabonsu.

Wannan adadi ma yana da lokacin da ya shafa: rabon asarar wajen ma'adini zuwa ta kai tsaye ne na **shekaru biyar**. Bai kamata a haɗa shi da tasirin shekaru goma da aka auna a ma'aunin 0–100 ba.

Tasirin bai zama iri ɗaya a ko'ina ba. Binciken ya nuna damuwa musamman ga Jamhuriyar Dimokuraɗiyyar Kongo saboda ta haɗa babban filin ma'adinai kai tsaye da babban ƙarin sare daji a wajen ma'adinai. Wasu ƙasashe sun nuna babban tasirin dangi a wajen ma'adini, amma filayen hakarsu kai tsaye sun fi ƙanƙanta. Idan aka raba bisa irin ma'adinin da ake haƙa, ma'adinan cobalt da copper — sinadarai masu muhimmanci ga batura, hanyoyin wutar lantarki da sauyin makamashi — su ne suka ba da mafi girman jimillar ƙarin sare daji a kiyasin binciken.

Me ya sa asarar wajen filin ma'adini take da muhimmanci

Binciken tasirin muhalli yakan fara da iyakar aikin kai tsaye. Wannan yana da ma'ana: ramin yana gani, izini yana da iyaka, kuma kamfani zai iya bayyana ababen more rayuwar da yake son ginawa.

Amma dazuzzuka ba sa bin iyakokin doka kawai. Suna amsa ga sauƙin shiga da sabbin abubuwan da ke sa share ƙasa ya zama mai amfani. Ma'adini na iya kawo hanyoyi, ma'aikata, kuɗi, matsugunai da ƙarin buƙatar abinci. Wannan zai iya sa dajin da ke kusa ya zama mafi sauƙin shiga, mafi riba ko mafi zama dole a sare.

Saboda haka babban ra'ayin takardar ba lamba guda ba ne. Shi ne bambanci tsakanin asarar **kai tsaye** da asarar da aikin ma'adini **ya tayar**.

Idan supply chain ta ƙirga filin ma'adinin kawai, za ta iya rage a lissafi canjin amfani da ƙasa da hakar ta haifar. Idan binciken tasirin muhalli ya tsaya a iyakar izinin ma'adini, zai iya rasa asarar da aikin ya taimaka wajen sa ta fi yiwuwa. Kuma idan ana tallata wani samfur a matsayin "mai tsabta" saboda yana tallafa wa makamashi mai sabuntawa, wannan ba ya sa jerin kayan da aka yi amfani da su ya zama mai tsabta kai tsaye.

Abin da wannan binciken bai tabbatar ba

- Bai nuna cewa **sauyin makamashi mummunan abu ne** ba. Ya nuna cewa ma'adanai da ake amfani da su a ababen more rayuwa na zamani, ciki har da na sauyin makamashi, na iya zuwa da babban kuɗin amfani da ƙasa.
- Bai nufin kowane ma'adini yana haifar da hectare 33.9 na asarar wajen ma'adini ga kowane hectare na asarar kai tsaye ba. Wannan matsakaicin kiyasi ne daga manyan rukunin ma'adinai, ba hasashen wani aiki guda ba.
- Bai tabbatar cewa duk bishiyar da ta ɓace kusa da ma'adini an sare ta ne saboda ma'adinin ba. Binciken ya yi amfani da hanyar quasi-experimental don kiyasta **ƙarin** asarar a matakin yawan wurare.
- Bai ɗora alhakin asara ga wani kamfani, izini ko mai saye takamaimai ba. Wannan yana buƙatar bin diddigin kowane aikin ma'adini daban.
- Bai rufe duk tasirin hakar ma'adinai ba. Gurbatar ruwa, yanayin aiki, rarrabuwar muhallin halittu, rikicin haƙƙoƙi da ƙaurar jama'a ba su cikin babban ma'aunin asarar daji a nan.
- Binciken bai shafi duniya baki ɗaya ba. Ya mayar da hankali ga dazuzzuka masu kauri na Afirka kudu da Sahara.

Yaya ƙarfin shaidar yake?

Ga kiyasin sare daji kai tsaye, shaidar tana da ƙarfi a ma'aunin nahiyar. Binciken ya yi amfani da bayanan amfani da ƙasa da rufin daji da aka riga aka wallafa don gano asarar da ta yi daidai da abubuwan ma'adinai kai tsaye.

Ga ƙarin asarar da ke wajen ma'adini, shaidar ma tana da muhimmanci, amma tana dogara da samfurin lissafi. Difference-in-differences an tsara shi ne don kiyasta tasirin dalili daga bayanan lura, musamman idan gwajin bazuwar rarrabawa ba zai yiwu ba. Marubutan sun yi amfani da hanyoyin zamani da suka fi jure bambance-bambancen rukuni kuma sun gwada ƙarfin sakamakon da wasu hanyoyin kiyasi. Wannan kyakkyawar hanya ce.

Duk da haka, ya kamata a karanta sakamakon a ma'aunin da aka yi shi. Takardar tana ba da ƙaƙƙarfan shaida cewa kafa ma'adini yana tare da **ƙarin sare daji bayan iyakar filin ma'adini** a duk tsarin da aka nazarta. Ba ta nuna wa kowane bishiya daban "wanda ya sa aka sare ta" daga tauraron dan adam ba.

Saboda haka karatun jama'a mafi amfani ba tsoro ba ne kuma ba watsi ba ne. Shi ne tsari mai kyau wajen aunawa: **idan ma'adini ya buɗe wani yanki ga sabbin ayyuka, binciken tasirinsa ya kamata ya duba bayan shingen ma'adinin.**

Me ya sa wannan yake da muhimmanci

Kalmar "makamashi mai tsabta" na iya ɓoye duniyar kayan da ake buƙata. Solar panels, batura, layukan wutar lantarki, motocin lantarki da data centers duk suna buƙatar ma'adanai. Wasu daga cikinsu suna fitowa ne daga wuraren da suke da dazuzzuka da bambancin halittu masu muhimmanci ga duniya.

Wannan ba ya sa rage hayaƙin carbon kuskure. Ci gaba da dogaro da makamashin fossil ma yana da manyan kuɗaɗe ga ƙasa, iska, ruwa da yanayi. Amma yana nufin cewa sauyi zai iya zama **mafi tsabta** fiye da tsohon tsarin makamashi ba tare da ya zama **marar tasiri ga muhalli** kai tsaye ba.

Darajar wannan takarda ita ce tana sa wannan ɓoyayyen yanayin ƙasa ya fi wahalar yin watsi da shi. Saƙonta shi ne: kada a ƙirga ramin ma'adini kawai. A ƙirga canjin dajin da ke kewaye da shi. A ƙirga hanyoyi, gonaki da matsugunan da suka biyo bayan hakar. A saka sare daji a wajen filin ma'adini cikin binciken tasirin muhalli, ikirarin "no net loss" da supply chains masu alkawarin rashin sare daji.

Wannan labari ya fi manyan taken "green minerals suna da kyau" ko "green minerals suna da muni" amfani. Abin da yake cewa shi ne: **tushen kayan da sauyin makamashi yake dogara da shi yana da sakamako, kuma ya kamata a ga sakamakon kafin a kira supply chain mai tsabta.**

Takaitaccen bayani

Wani bincike a *Nature* ya nazarci rukunin ma'adinai **16,627** a dazuzzuka masu kauri na Afirka kudu da Sahara daga 2001 zuwa 2020. Ya kiyasta **hectare 187,070** na sare daji kai tsaye daga abubuwan ma'adini kamar ramuka, tafkunan tailings da tudun tarkace. Ta amfani da difference-in-differences, marubutan sun kuma kiyasta ƙarin sare daji a kusa da ma'adinai idan aka kwatanta da wuraren da ba a haƙa ba: bayan shekaru goma, yawan sare daji ya

kasance **maki 8 mafi girma a ma'aunin 0–100** cikin kilomita 1, kuma tasirin ya ci gaba har zuwa 20 km. A wani lissafi na shekaru biyar, kowane hectare na sare daji kai tsaye saboda ma'adini yana tare da matsakaicin **hectare 33.9** na ƙarin asarar daji mai kauri a wajen ma'adinin, galibi ta faɗaɗa noma da matsugunai. Ma'adinan cobalt da copper sun ba da mafi girman jimillar ƙarin sare daji a binciken. Sakamakon bai nuna cewa sauyin makamashi mummunan abu ne ba; yana nuna cewa kuɗin amfani da ƙasa na supply chains na ma'adanai yana kaiwa fiye da filin ma'adinin da ake gani.

Bincike ba tare da ƙarin gishiri ba

Abin da takardar ta nuna: Hakar ma'adinai a dazuzzuka masu kauri na Afirka kudu da Sahara ta haifar da babban sare daji kai tsaye daga 2001 zuwa 2020; bayan kafa ma'adini an ga ƙarin sare daji a kewayensa idan aka kwatanta da wuraren da ba a haƙa ba; asarar wajen ma'adini na iya zarce filin ma'adinin kai tsaye sosai; kuma wasu ma'adanai masu muhimmanci ga sauyin makamashi suna da babban jimillar ƙarin sare daji a wannan bayanan.

Abin da yake yiwuwa amma ba a tabbatar ba: Ma'adinai da yawa na mutum ɗaya suna da tasirin waje fiye da abin da iyakar izininsu ke nuna; tsauraran binciken tasirin muhalli da ƙa'idojin supply chain za su iya rage wani ɓangare na wannan asara; kuma irin wannan ɓoyayyen tasiri na waje na iya kasancewa a sauran yankunan hakar ma'adinai na tropics.

Abin da bai nuna ba: Cewa duk ma'adinai suna da illa iri ɗaya; cewa duk asarar daji kusa da wani ma'adini ta samo asali daga wannan ma'adinin; cewa sauyin makamashi mummunan abu ne; cewa za a iya ɗora wa wani kamfani ko mai saye takamaimai alhakin asara ba tare da bin diddigin aikin ba; ko cewa sare daji shi ne kaɗai kuɗin muhalli da zamantakewa da ya kamata a kula da shi.

Manyan iyakoki: Kiyasin dalili daga bayanan lura, ba gwajin bazuwar rarrabawa ba; ƙididdigar faɗin nahiyar maimakon ɗora alhaki ga kowane aikin ma'adini; mayar da hankali ga dazuzzuka masu kauri na Afirka kudu da Sahara; kuma kiyasin ya dogara da ingancin bayanai, gano ma'adinai da zato na samfuran lissafi.

Yawan amincewar da ya dace ga mai karatu na gama gari: Babba cewa sare daji kai tsaye saboda hakar ma'adinai yana da muhimmanci a yankin da aka nazarta. Mai kyau cewa kafa ma'adini yana da alaƙa da ƙarin sare daji a wajen filin ma'adini a matakin yawan wurare. Ƙasa wajen ɗaukar matsakaicin rabon 33.9:1 a matsayin abin da zai faru ga kowane ma'adini guda. Matsayin da ya dace shi ne: supply chains na ma'adanai na iya zama dole, amma har yanzu suna buƙatar lissafi na gaskiya wanda ya wuce ramin ma'adini.

Majiyoyi

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