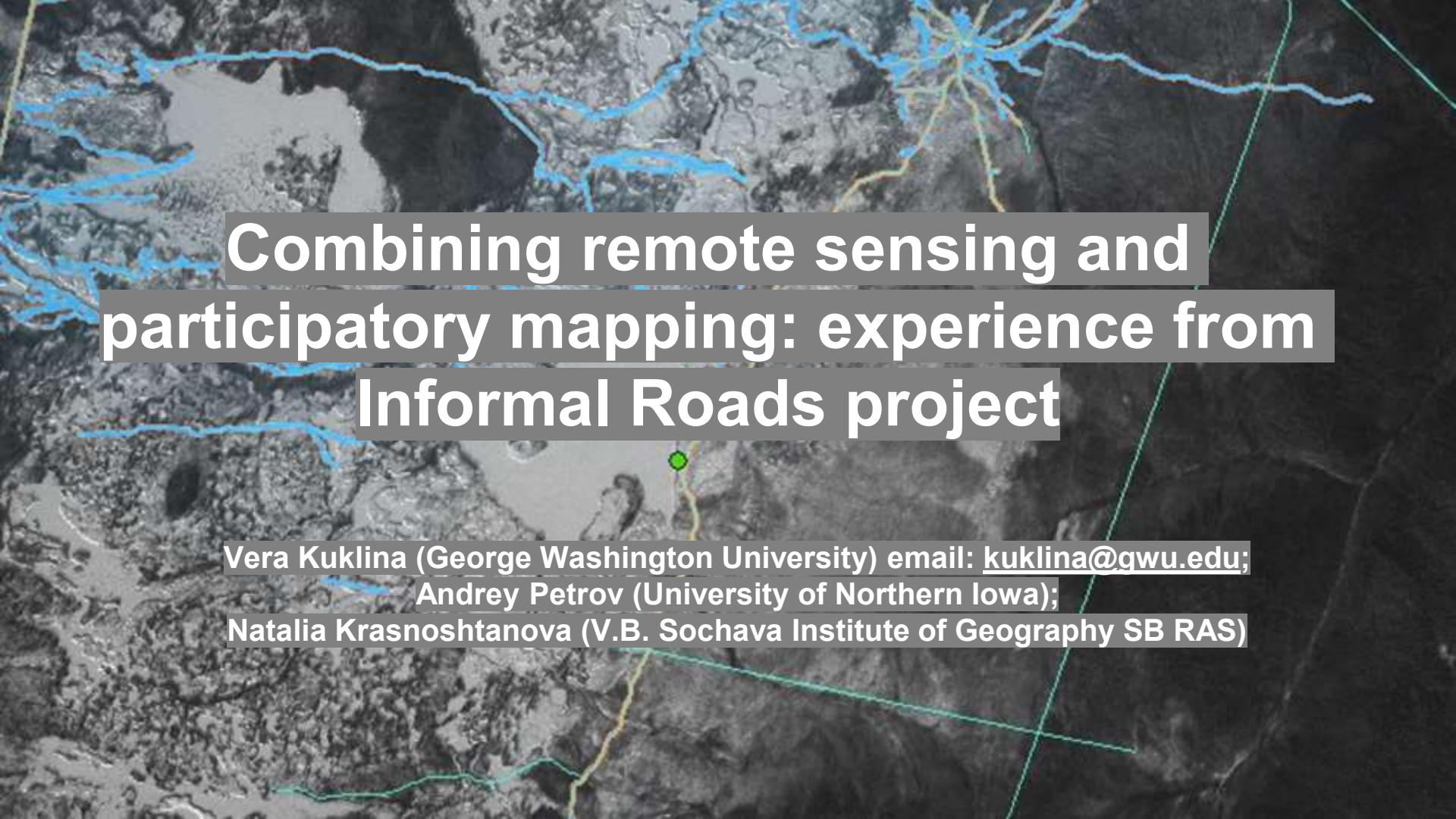

Combining remote sensing and participatory mapping: experience from Informal Roads project

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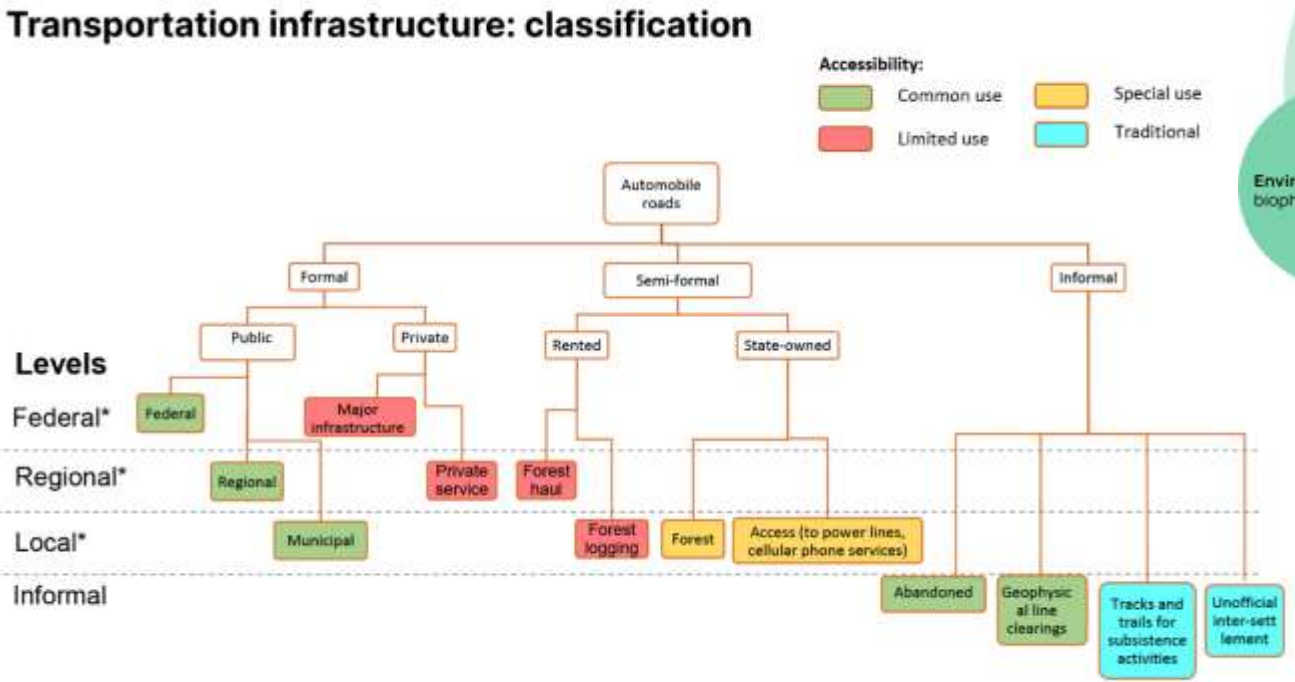
Informal roads as SETS



Data & study area:

- Field studies in Vershina Khandy, Kazachinsko-Lenskiy district in August 2019 and in Tokma Katangskiy district of Irkutsk region in March 2020:
  - 14 in-depth interviews
  - Mobile methods (interviews on the move, photos, observations)
  - Participatory mapping (SAS-Planet)
- Informal roads detection: OSM, WorldView (2015-2016), Planet, topographical maps
- Studies of fires: MODIS and VIIRS (2016) and Sentinel-2 (2017)

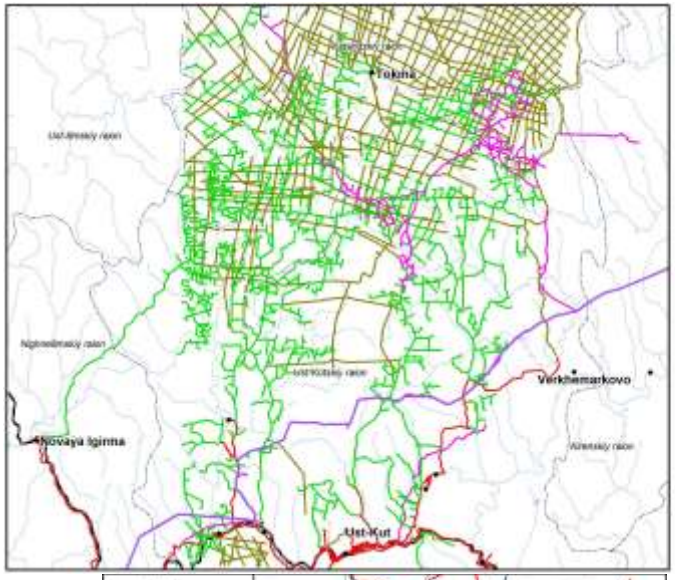
Study area:

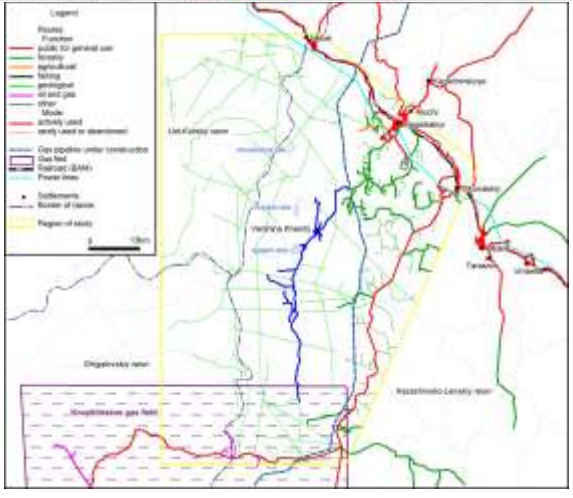
- continental climatic conditions (average annual T -5.8° C),
- discontinuous permafrost,
- prevalence of coniferous vegetation (taiga)

Characteristics	Tokma area	Vershina Khandy area
Villages	Village Tokma (54 people)	Village Vershina Khandy (from 6 to 20 people)
Study area (ha)	2107,000	696,500
Territories of Evenki traditional land use (ha)	1,115 (obshchina Tokma)	299,067 (obshchina Khandinskaya)
Major pipelines	Transneft: East Siberia – Pacific Ocean oil pipeline (ESPO)	Gasprom: Power of Siberia
Oil and gas service roads	Irkutsk Oil Company (INK)	Gasprom
Forest roads	Transsiberian Forest Company (TSLK)	RusForest forest company
Geophysical exploration	GeoTek	Gasprom sub-contractors

Areas affected by informal roads

Roads		Total length (km)		Affected area (square kilometers)	
		Tokma	Vershina Khandy	Tokma	Vershina Khandy
Federal	railroad	146	65	219	97.5
Regional	roads of common use	211	317	443	317
Local	service roads	787	13	472.2	7.8
	municipal	232	23	139.2	13.8
	forestry	4513	469	2707.8	281.4
Traditional	geophysical line clearings	3915	1146	391.5	114.6
	subsistence	40	111	4	11.1
Total roads		9844	2144	4376.7	843.2
Study area				21070	6965
Affected area %				20.77	12.11

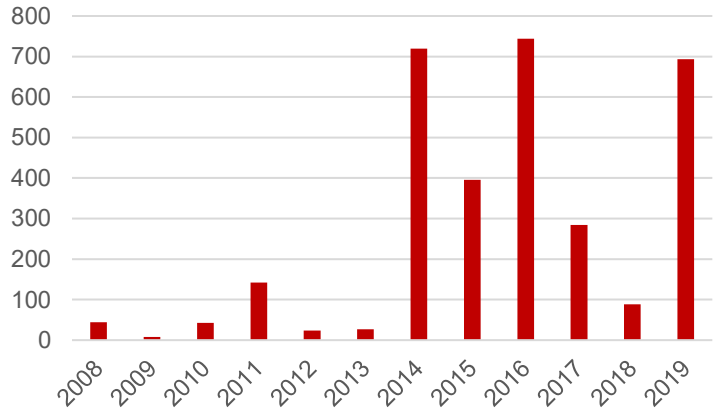


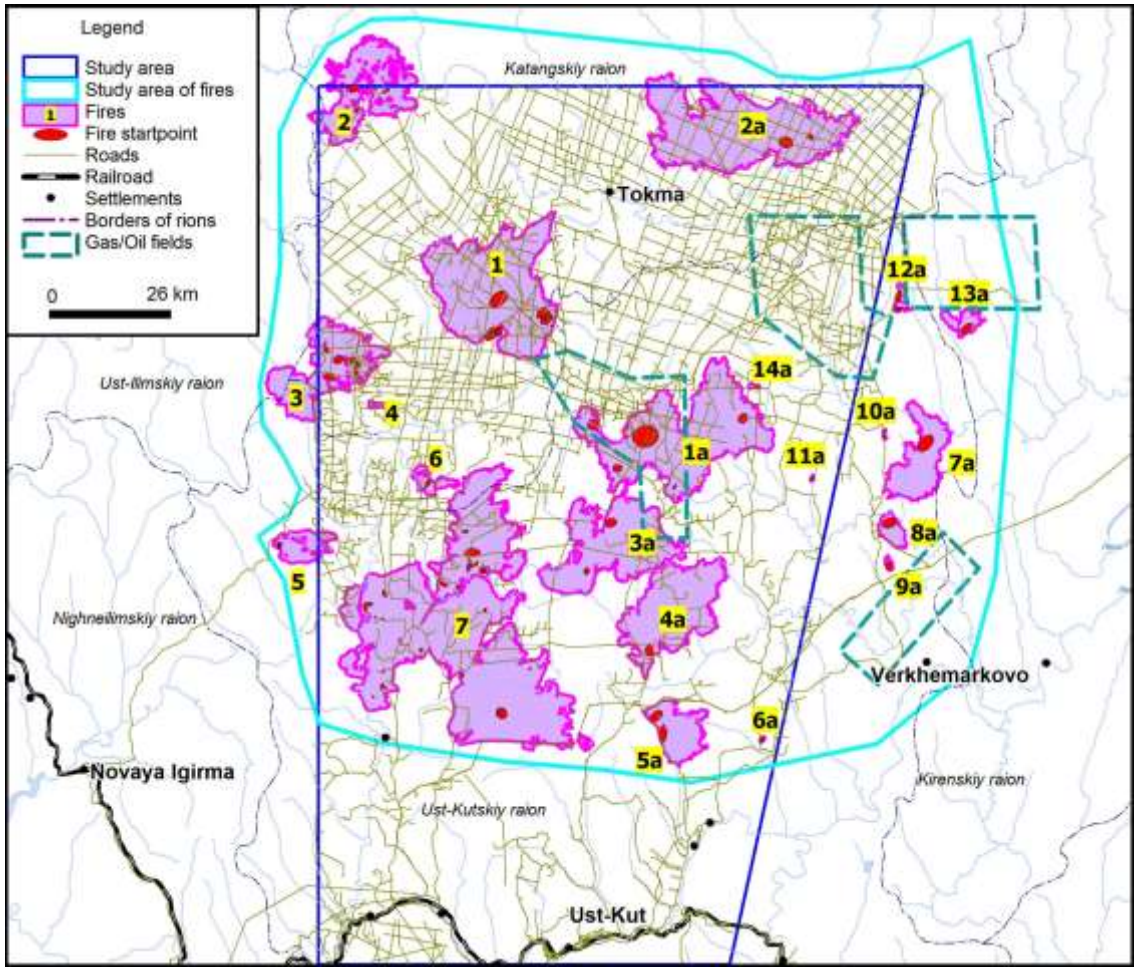


Wildfires in 2016:

- July t in Tokma exceeded the average by 7.1° C (22.7° C vs. 15.6° C)
- Study area 2,353,000 ha
- Burnt area: 475,500 ha
- Share of burnt area: 20.21 %

Official estimates of burnt area in Irkutsk region (thousand ha)





Cause and boundaries of wildfires

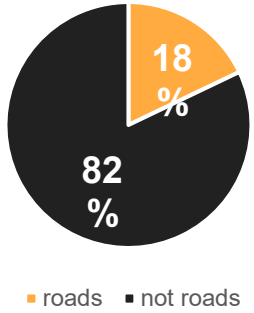
“My hunting plot burned after them, it was from them. They drove their tanks in summer. It’s not allowed in summer, it’s forbidden. They have exhaust pipes, diesel fuel there, sparks fly. And where the tank was moving - the last three fires. My Siberian pine forest, my winter hut, all burnt because of them” (male, 35, Vershina Khandy, 4 August 2019)

”These geotecs, they make profili in the summer. And in winter too, of course. Once he told you: "We are all year round." Because the volumes are large, they work. And the main thing is that someone gives them permission to do this work anyway during a fire-hazardous period (female, 60, Tokma, 10 March 2020).

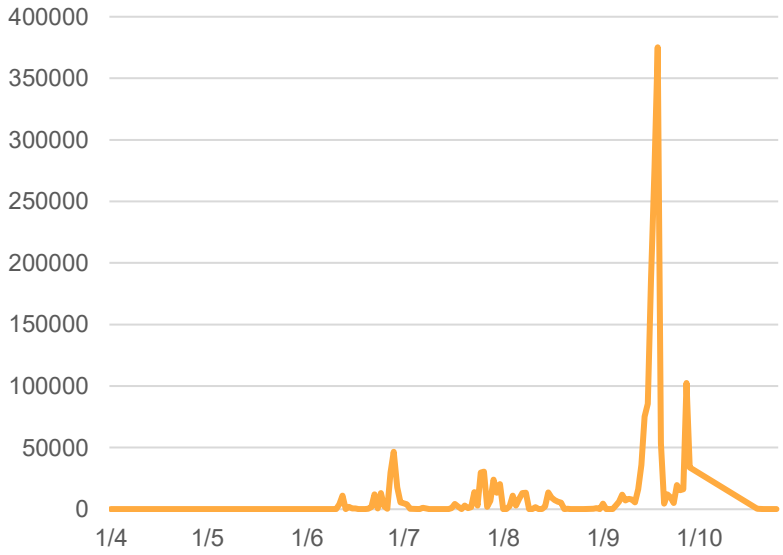
“And after the lumberjacks, these fires started. We then believe that it is they who are to blame for these fires. They throw so much wood there, well, how much they take there ... half of the wood is left, and in heaps they arrange. They begin to burn them, ... well, maybe it would be possible to burn them, if there was a guard, it is necessary to keep watch so that the fire would not go. And where will you show up in the summer? It would be another matter in winter. Well, that's all, and all these conflagrations begin precisely with cutting areas for some reason. (male, 70, Tokma, 9 March 2020)

Fire boundaries

roads	737,10	18%
not roads	3381,14	82%
All, km	4118,24	

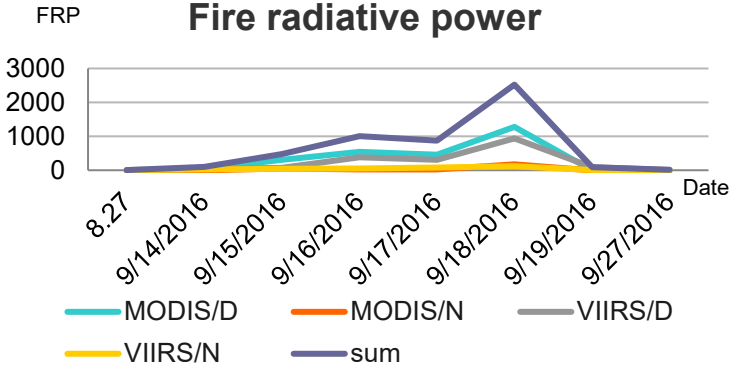


Fire radiative power (MODIS & VIIRS sum)

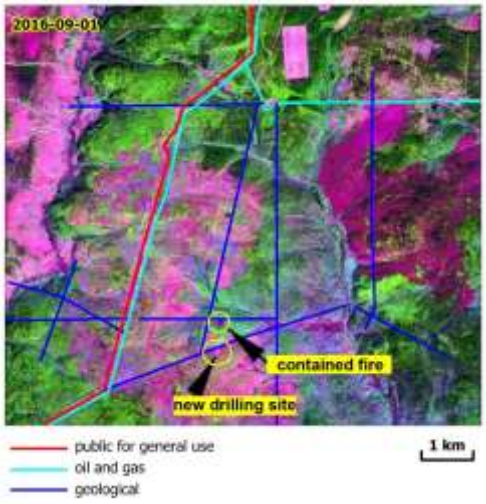


Fire propagation:

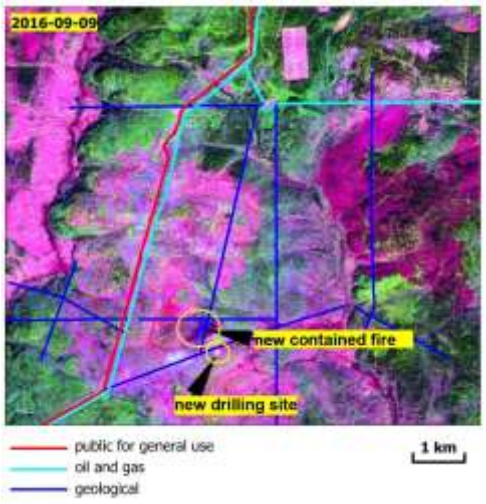
“in the first year they (roads) still hold back the fire, if the fire is low. They stopped, dug in, two weeks passed. It was actually extinguished, but somewhere the stump remained in the middle. And here the needles have already dried up. And it was undergrowth, not these giants that stood, but such a medium-sized. There, along the road on which you were traveling, everything was torn to the ground, dumping, gravel. When there was a low fire - everything stopped. Look - there is undergrowth, the bottom has passed, all the needles remained, but dried up. Heat, wind, inside this fire - it came from somewhere, swelled up, fire climbed up and flew like gunpowder and flew across the road..” (male, 35, Vershina Khandy, 4 August 2019)



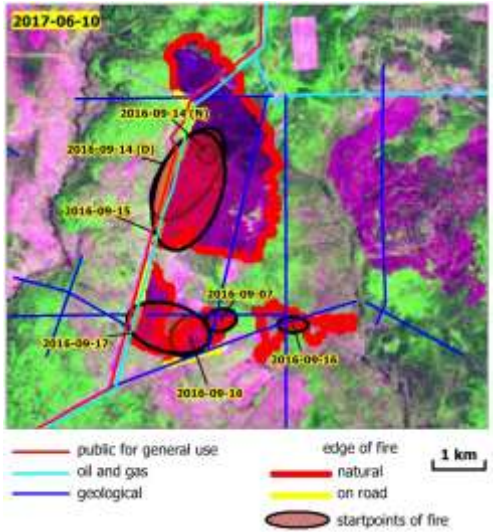
contained fire



new contained fire



Burnt area



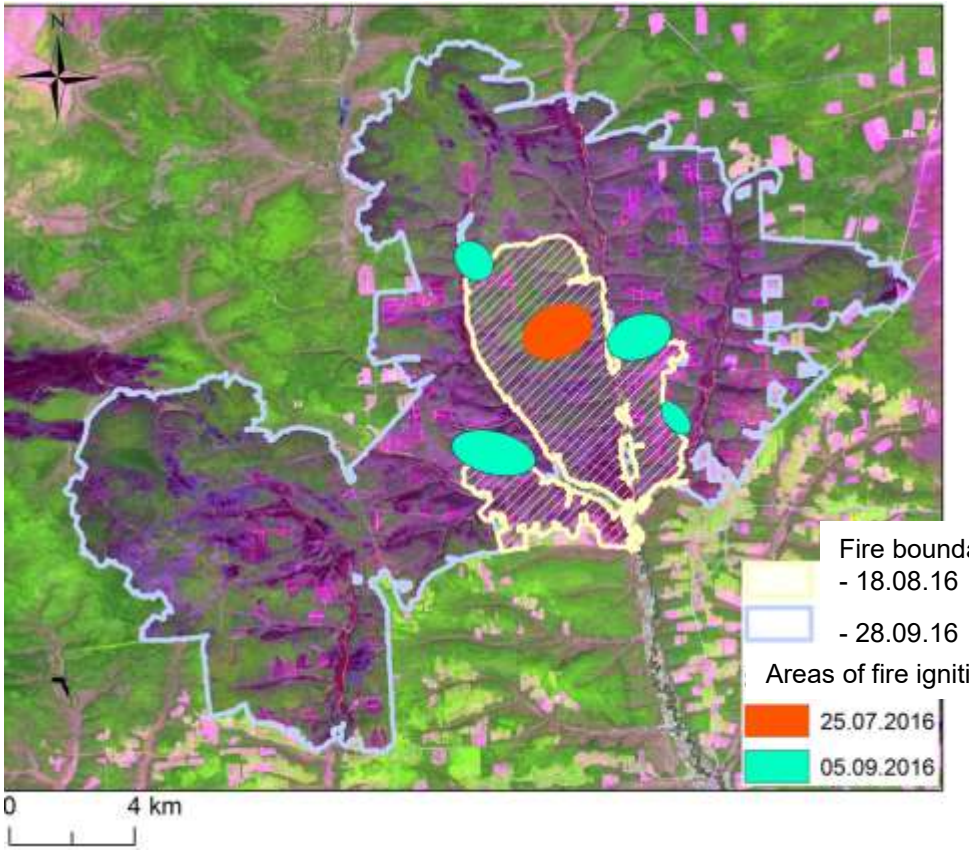
Boundaries of fire

Fire # 7a

‘Zombie fires’

“Underground smouldering fires resurfaced early in 2020, contributing to the unprecedented wildfires that tore through the Arctic this spring and summer. An international effort is needed to manage a changing fire regime in the vulnerable Arctic” (McCarty, Smith & Turetsky 2020).

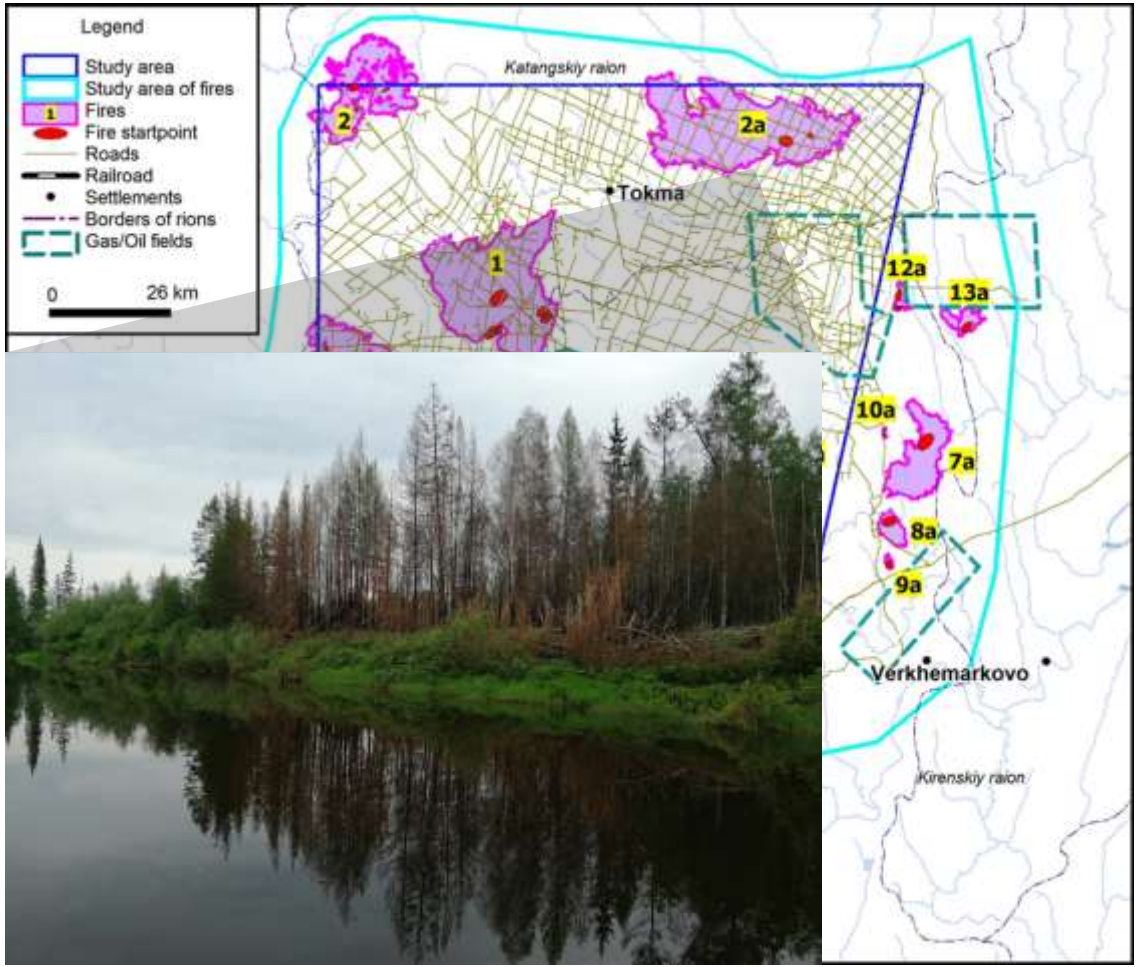
“Last year there were fires. winter came, everything seemed to have died down. The month of January is burning, the month of February is burning. Everything goes underneath. Kolya Kuznetsov, last year, on January 6, was coming from the forest. And he stopped on his road, and he filmed on the phone: the fire reached the road, where the snow was trampled, and stopped. In winter! Summer fires were still burning at Rinat’s (hunting area) until February at a swampy corner there: a cedar forest, a spruce forest. <…> now the whole corner is lying. We say that these piles (left after forestry) were set on fire in March. Or maybe one (fire) went inside from this heap, and then it came out and in May it could come out, maybe it smoldered” (Male, 60, Tokma, 10 March 2020).



Fire # 3

Effects of fire # 2a:

- *“It caught fire in May, between 24-25, but it was from the village that we already saw smoke in the direction of Iryshki, maybe it started earlier. So it burned all summer, then it will subside, then it will light up again, and in September then you remember how everything was covered with smoke, flaring up. There is a very large area burned out. And I jumped out on Nepa, and Kirana burned out along Surinda. "* (male 60 Tokma, 2020)
- *GP: What's going on? We all abandoned everything, everything burned out.*
- *VK: On Fiber, yes?*
- *GP: Everything burned out there, and there were a lot of drilling rigs. The rig is on the rig. What kind of hunting can there be? (*male 70 Tokma, 2018)



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Local and Indigenous partners

To be continued: Tracing footprints of human-nature relations: case-study of informal roads in changing Siberian taiga at ID:19 - Northern Roads and Railways: Social and Environmental Effects of Transport Infrastructure