

Roadless forests

Prof. Dr. Pierre Ibisch

www.roadless.online

同天下大爱，海航集团以美好成就新世界

以善为本，温暖有爱。在慈爱与诚的理念引导下，海航集团始终坚定履行企业社会责任，坚持为社会做点事、为他人做点事。为造福人类的幸福与世界和平无旁贷，努力让世界变得更美好。

HNA

海航集团

Sharing Dreams

共享梦想

Magazine: The 24th anniversary of the HNA group (2017)



Miami, USA



DPR Korea, March 2017

Roads 'create' new space ...

Miami, USA

Roads occupy space and take it away from nature & land use ...



Roads structure the economic and fragment the natural space ...



Zürich region, Switzerland

Roads are created in
every moment,
everywhere ...



Roads often are directly
mortal ... for animals



Sabah, Borneo, Malaysia

... and plants ...

Road to Balıkesir, Anatolia, Turkey

Impacts are context-
and ecosystem-
specific: e.g., grassland
ecosystems

Forests: three-dimensional, more complex systems suffer from more drastic impacts ...

Mountain forest
ecosystems worse ...



Santiago Morona Province, Ecuador



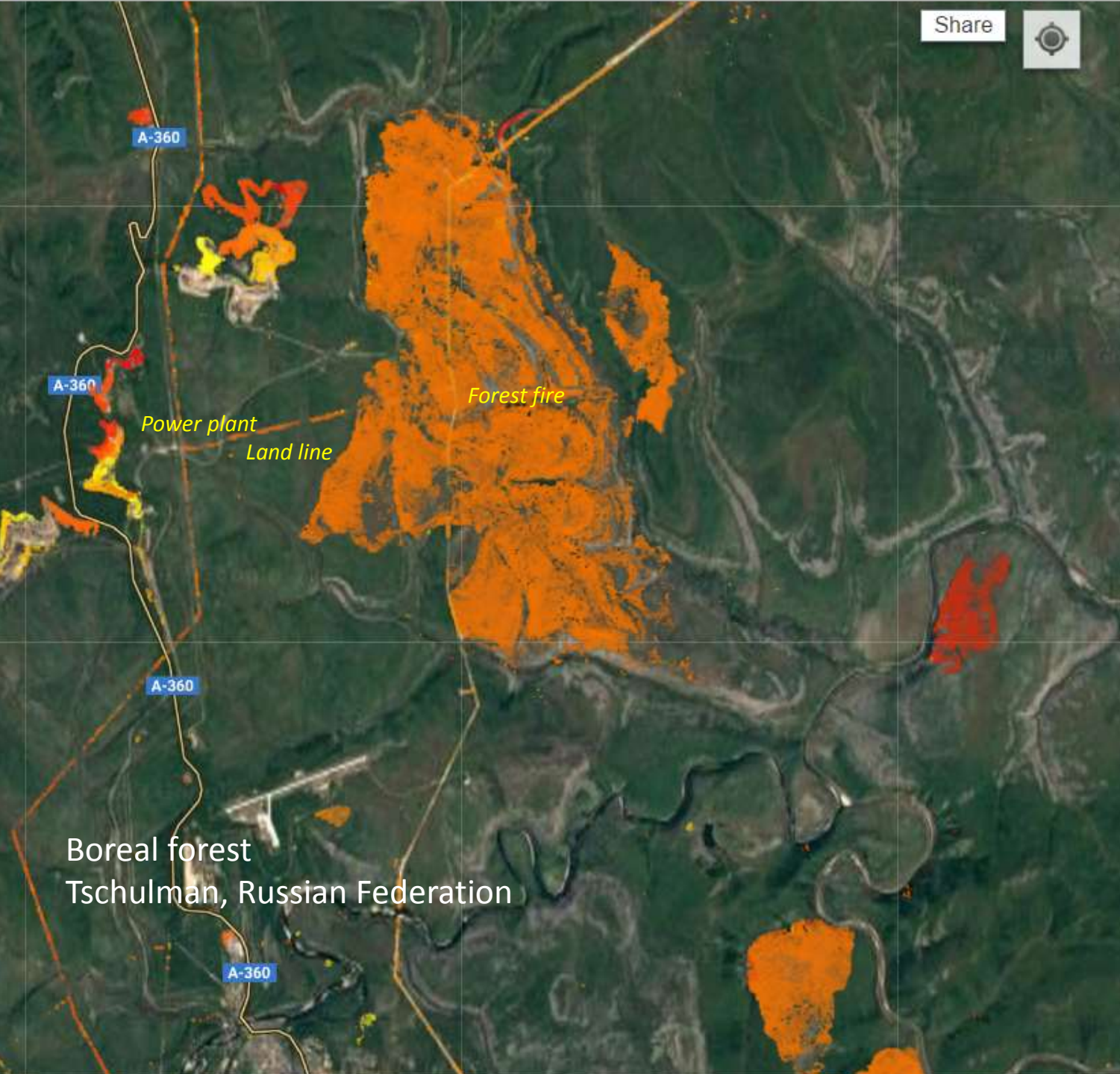
Beyond construction,
physical existence and
traffic ... also road and
roadside management
...

Santiago Morona Province, Ecuador



Antonina to Guaraquecaba, Paraná, Brazil

Share



(Background
with tree
cover loss:
Hansen et al.;
own
interpretation
using Google
Earth)

Boreal forest
Tschulman, Russian Federation

Legend





Archangelsk region, Russian Federation

Archangelsk region, Russian Federation



Kuala Lumpur region, Malaysia



Sabah, Borneo, Malaysia

Classification of road impacts

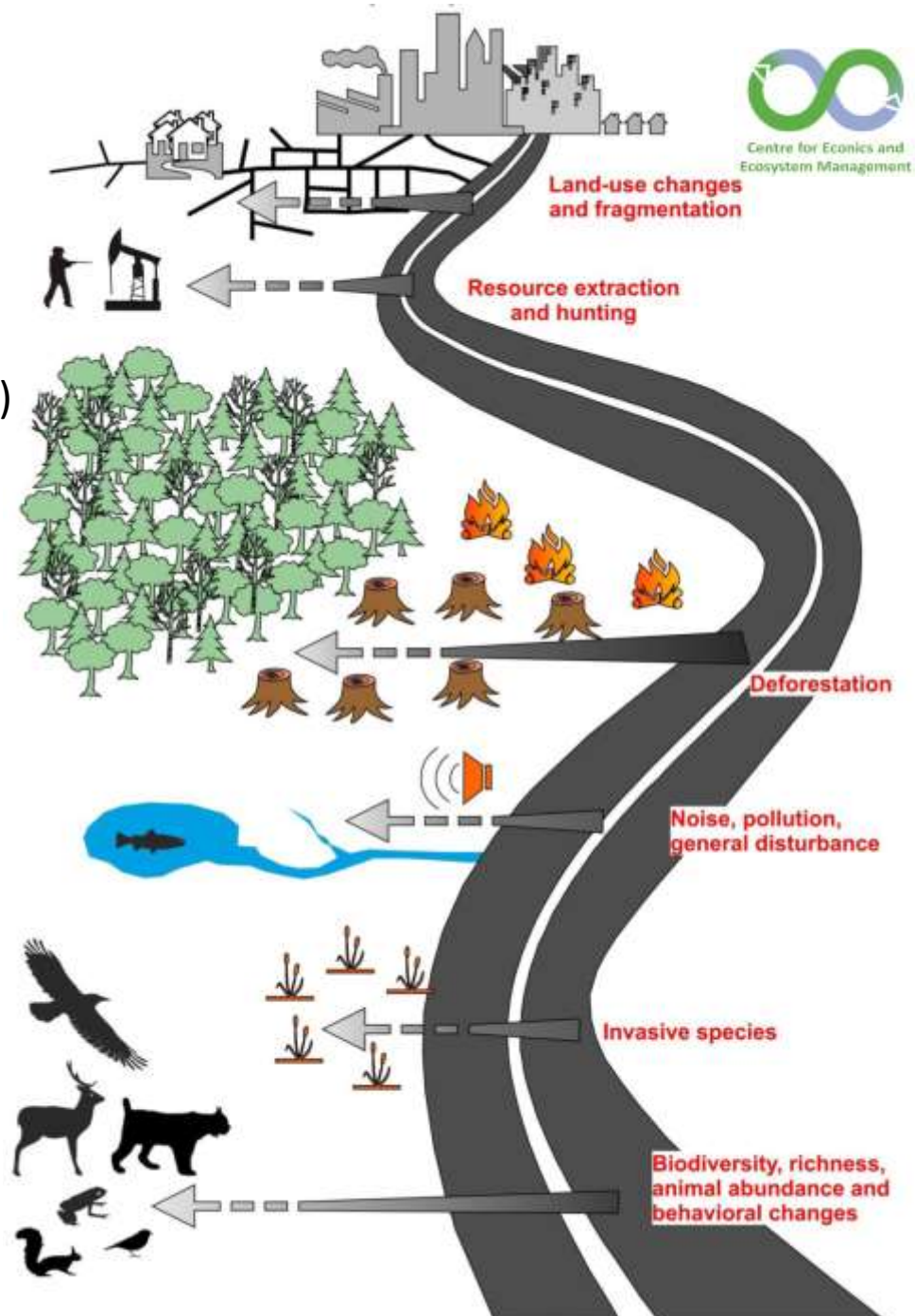
impairing forest ecosystem
functionality along the life-cycle of
a road (Note that road impacts also interact
in complex ways, often aggravating each other)

1. Construction, upgrading & removal
2. Physical existence
3. Traffic
4. Management of roads and roadsides
5. Degradation induced by human access

Impacting

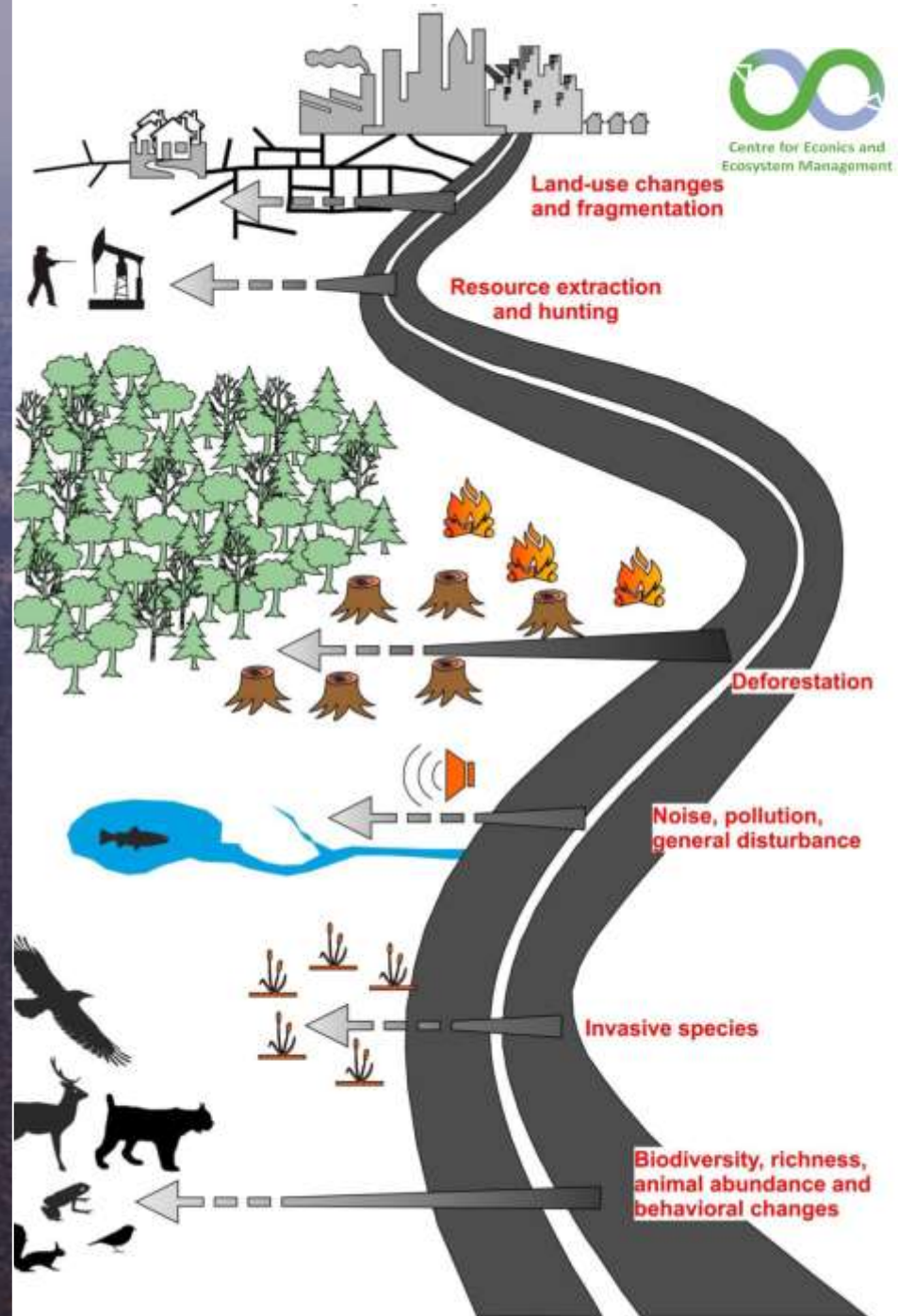
- Soil
- Water
- Air
- (Micro/ meso)Climate
- Organisms
- Biological/ ecological communities

(more details in Hoffmann et al. submitted to *Forest Ecosystems*)





Kalahari, Kavango region, Namibia





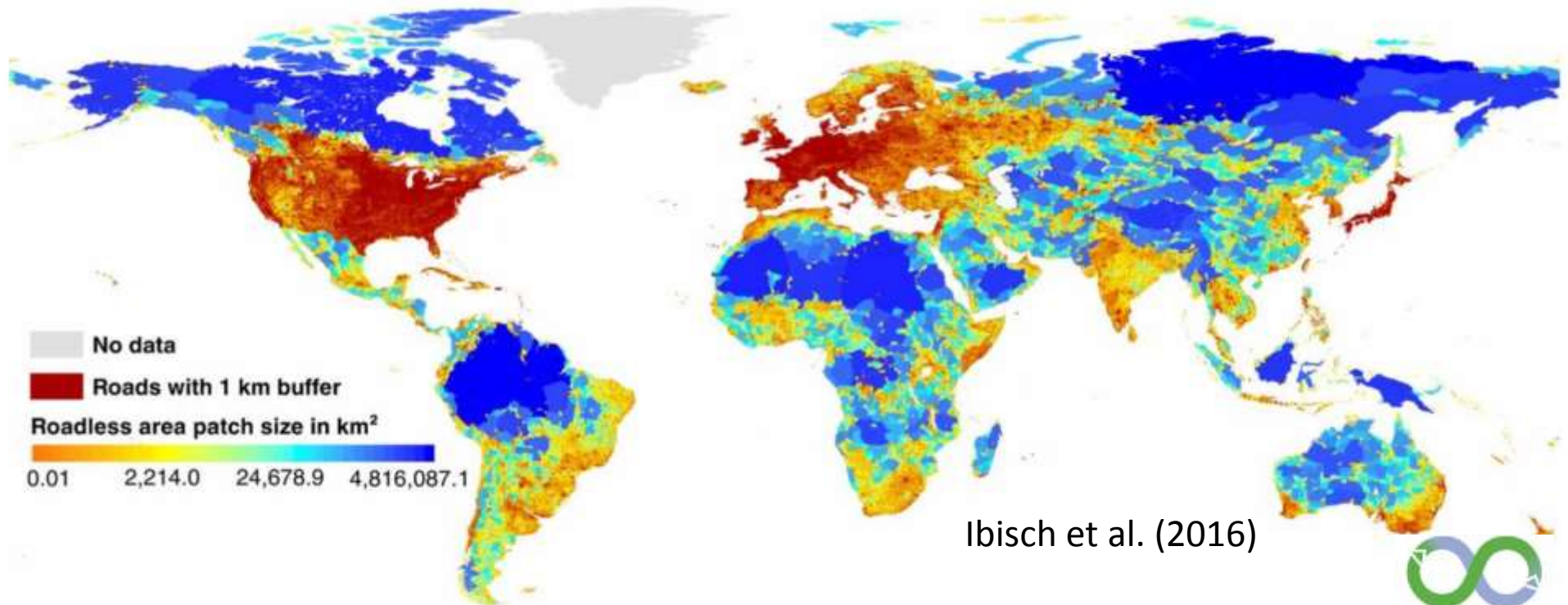
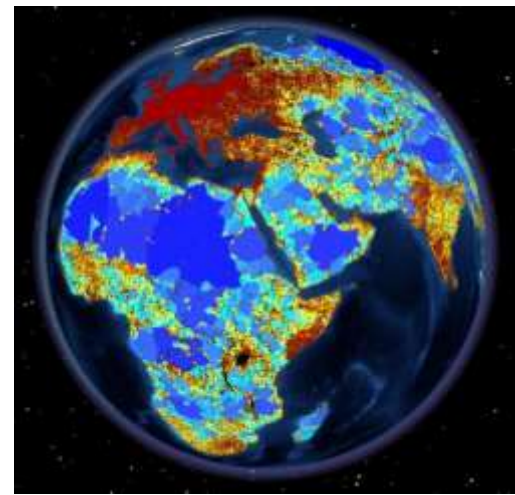
Kalahari, Kavango region, Namibia



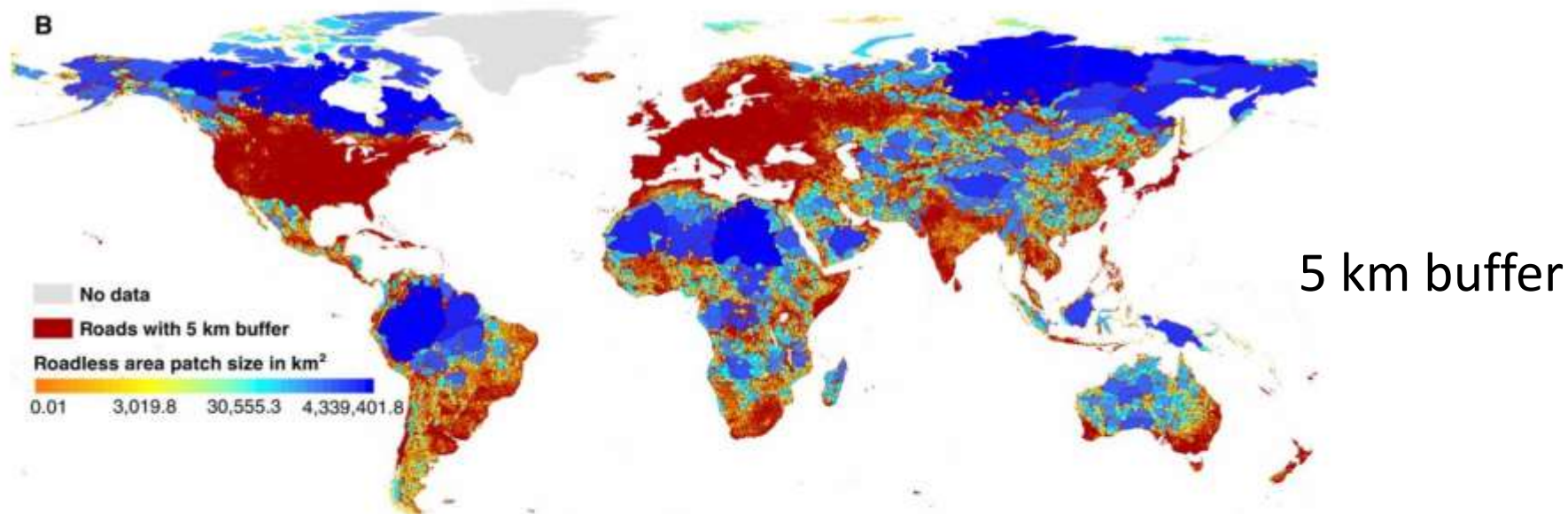
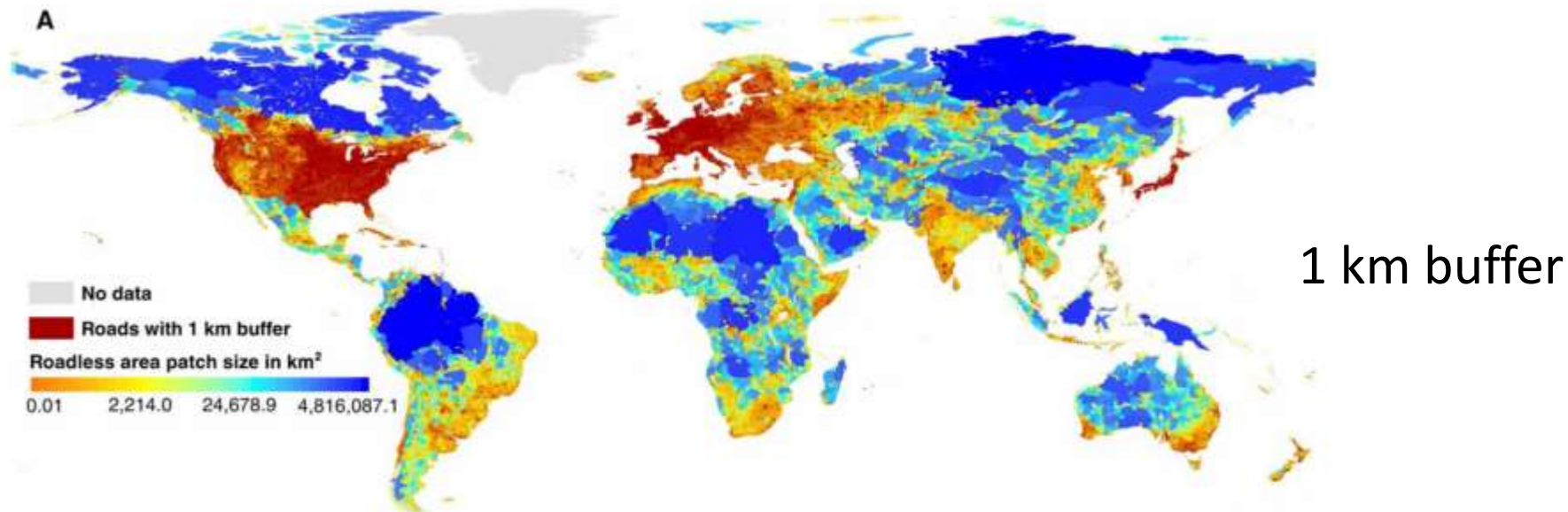
Lava Butte, Oregon, USA

Roadless: 1-km buffer to next road

- OpenStreetMap 2013: 36 Million km roads
- CIA World Factbook estimation 2013: 64 Million km roads



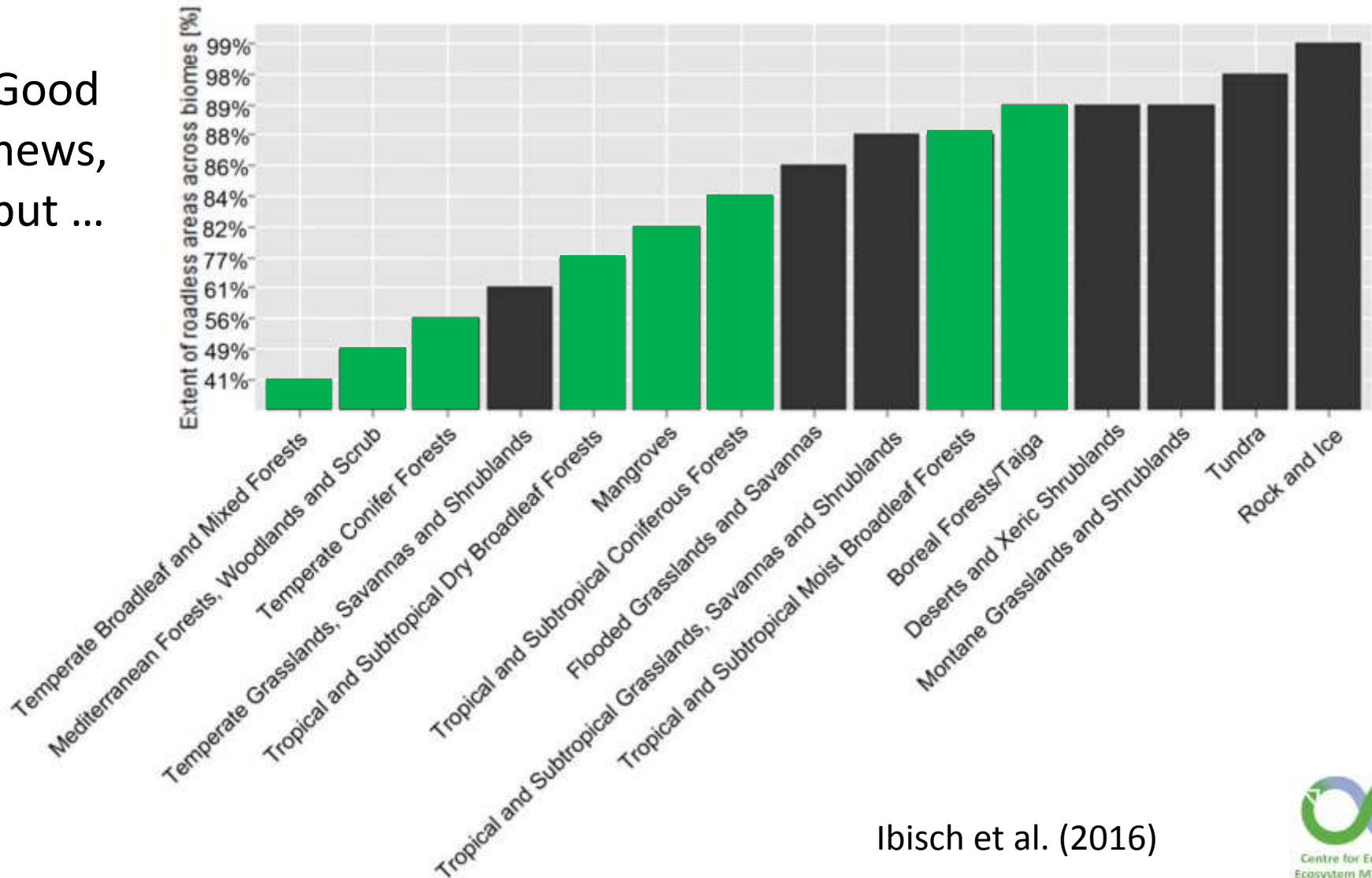
Ibisch et al. (2016)



Ibisch et al. (2016)

Fig. S2. The global distribution of roadless areas based on a (A) 1-km and a (B) 5-km buffer to all roads included in the OpenStreetMap data set (11/2013).

Good
news,
but ...



Ibisch et al. (2016)

Fig. S10. Extent of roadless areas across biomes (without freshwater bodies, Antarctica and Greenland) according to classification by Olson et al. (2001) (51) and based on 1-km buffer to all roads included in the OpenStreetMap data set (11/2013).

Temperate Broadleaf and Mixed Forests in Roadless Area Patches

>40% roadless

... percentage
of roadless vs.
distribution of
size classes /
degree of
fragmentation

1 km buffer

RLA size classes	984,3 - 1233,0	7381,4 - 8712,2	69471,8 - 88048,9
Area in km²	1233,1 - 1517,8	8712,3 - 10269,0	88049,0 - 112294,8
0,0 - 16,0	1517,9 - 1836,1	10269,1 - 11950,5	112294,9 - 152056,6
16,1 - 54,7	1836,2 - 2215,6	11950,6 - 13967,5	152056,7 - 203830,7
54,8 - 115,2	2215,7 - 2679,0	13967,6 - 16610,5	203830,8 - 296316,0
115,3 - 197,8	2679,1 - 3213,5	16610,6 - 19872,2	296316,1 - 506038,5
197,9 - 304,0	3213,6 - 3788,7	19872,3 - 24314,5	506038,6 - 1299885,6
304,1 - 433,9	3788,8 - 4469,2	24314,6 - 30776,5	1299885,7 - 3333526,7
434,0 - 587,2	4469,3 - 5268,2	30776,6 - 39679,0	3333526,8 - 4816087,2
587,3 - 769,2	5268,3 - 6209,3	39679,1 - 52413,0	
769,3 - 984,2	6209,4 - 7381,3	52413,1 - 69471,7	

Source:

Data from OpenStreetMap, ODb1.0. ESRI Data and Maps 2006, Tnc_terr_ecoregions, The Nature Conservancy.
Basemap: Canvas/World Light Grey Base, Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community.
Map created by Monika Hoffmann
20/08/2014

Coordinate System: GCS WGS 1984

Datum: WGS 1984

Units: Degree



Roadless areas in temperate forests of Germany (Eifel)

www.roadless.online

+

-

Small, but ...
not beautiful

0 0.15 0.3km

Roadless area in temperate forests of Germany (Eifel)

www.roadless.online

Map data © OpenStreetMap contributors, CC-BY-SA



POWERED BY
esri

Unmapped forest roads and skidding trails in roadless forest

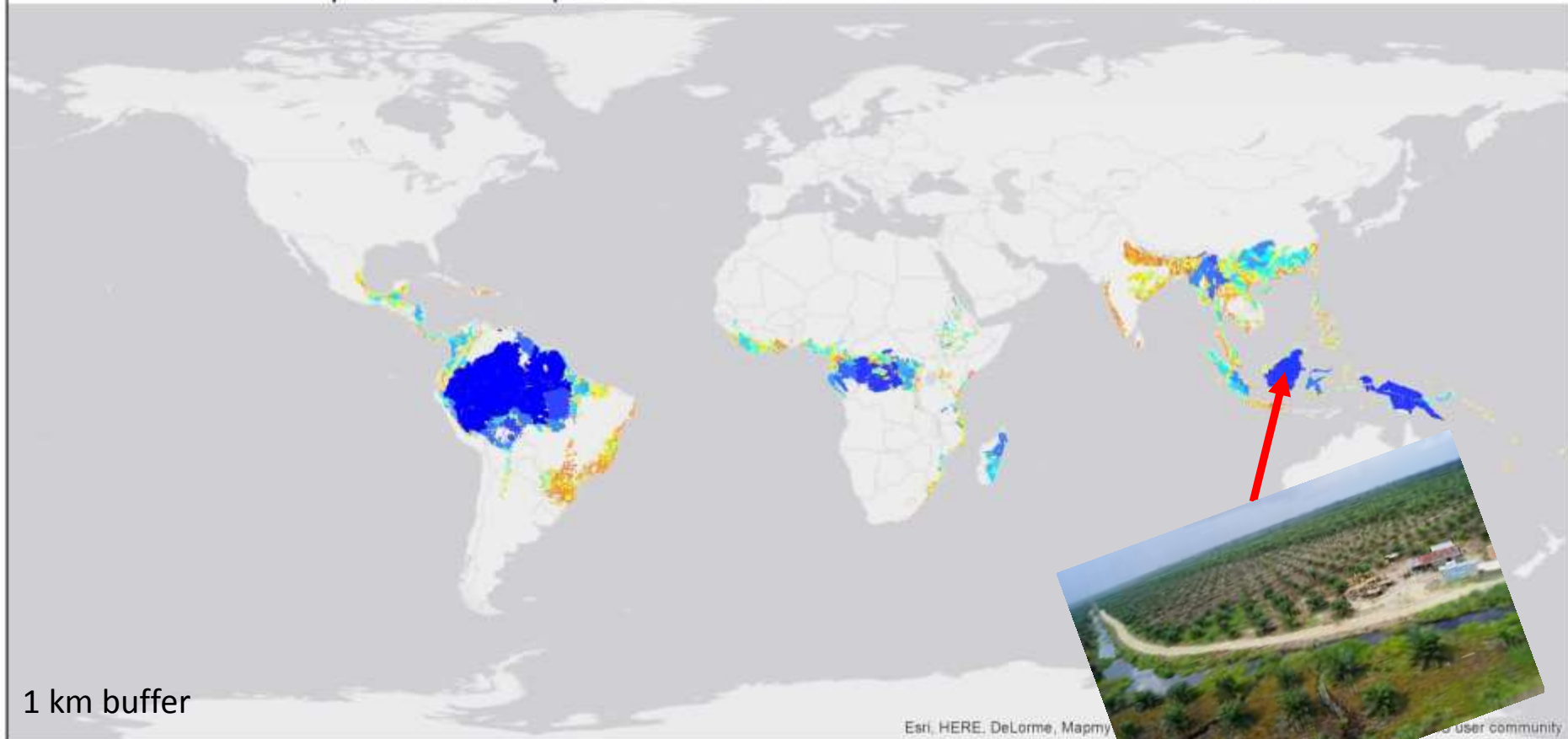
Small, but ...
not beautiful

Roadless area in temperate forests of Germany (Eifel)

Google Earth

Bildaufnahmedatum: 4/7/2015 50°05'18.19" N 6°40'34.89" O Höhe: 497 m Sichthöhe: 2.60 km

Tropical and Subtropical Moist Broadleaf Forest in Roadless Area Patches



RLA size classes					
Area in km²					
0.0 - 16.0	984,3 - 1233,0	7381,4 - 8712,2	69471,8 - 88048,9		
16,1 - 54,7	1233,1 - 1517,8	8712,3 - 10269,0	88049,0 - 112294,6		
54,8 - 115,2	1517,9 - 1838,1	10269,1 - 11950,5	112294,9 - 152056,6		
115,3 - 197,8	1838,2 - 2215,6	11950,6 - 13967,5	152056,7 - 203830,7		
197,9 - 304,0	2215,7 - 2679,0	13967,6 - 16610,5	203830,8 - 296316,0		
304,1 - 433,9	2679,1 - 3213,5	16610,6 - 19872,2	296316,1 - 506038,5		
434,0 - 587,2	3213,6 - 3788,7	19872,3 - 24314,5	506038,6 - 1299885,6		
587,3 - 769,2	3788,8 - 4469,2	24314,6 - 30776,5	1299885,7 - 3333526,7		
769,3 - 984,2	4469,3 - 5268,2	30776,6 - 39679,0	3333526,8 - 4816087,2		
	5268,3 - 6209,3	39679,1 - 52413,0			
	6209,4 - 7381,3	52413,1 - 69471,7			

Source:
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 Coordinate System: GCS WGS 1984
 Datum: WGS 1984

Data quality

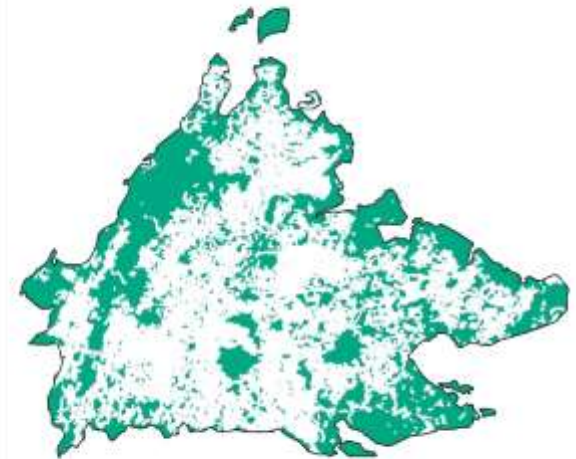
Sabah,
Borneo



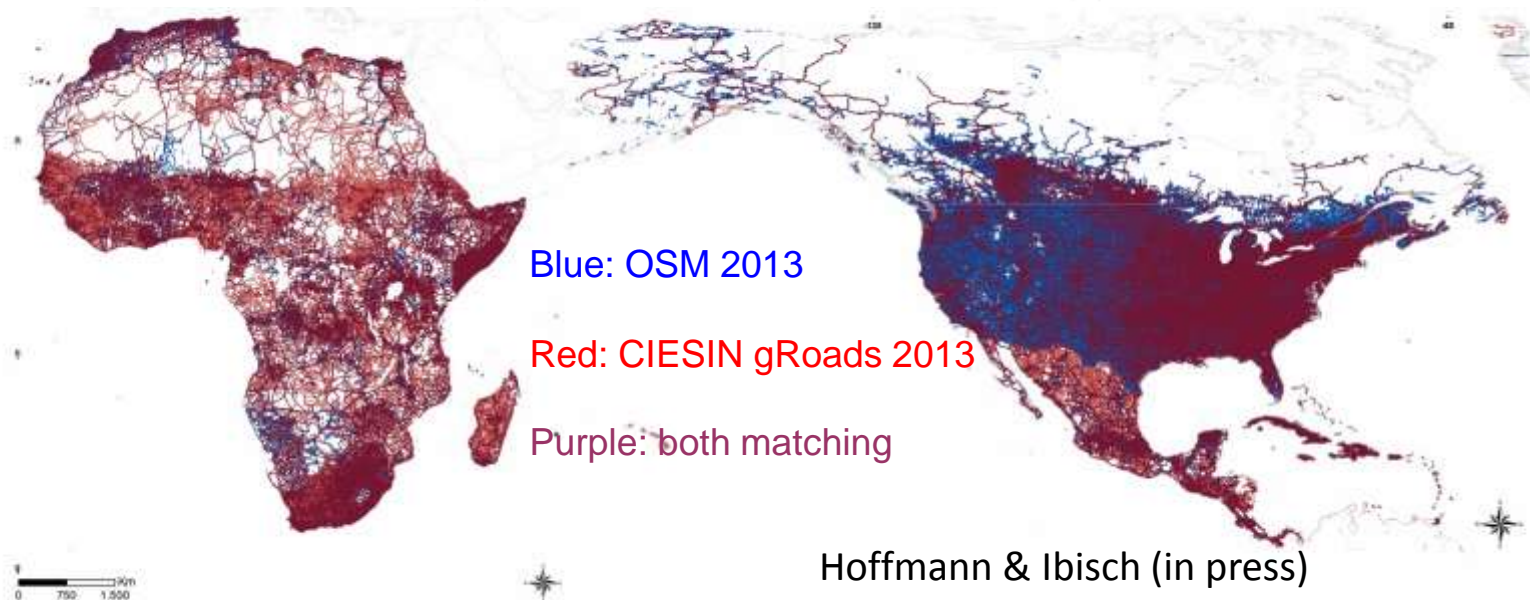
OpenStreetMap



CIESIN



CIFOR



Blue: OSM 2013

Red: CIESIN gRoads 2013

Purple: both matching

Hoffmann & Ibisch (in press)

Boreal biome

■ Roads with 1 km buffer - Boreal biome

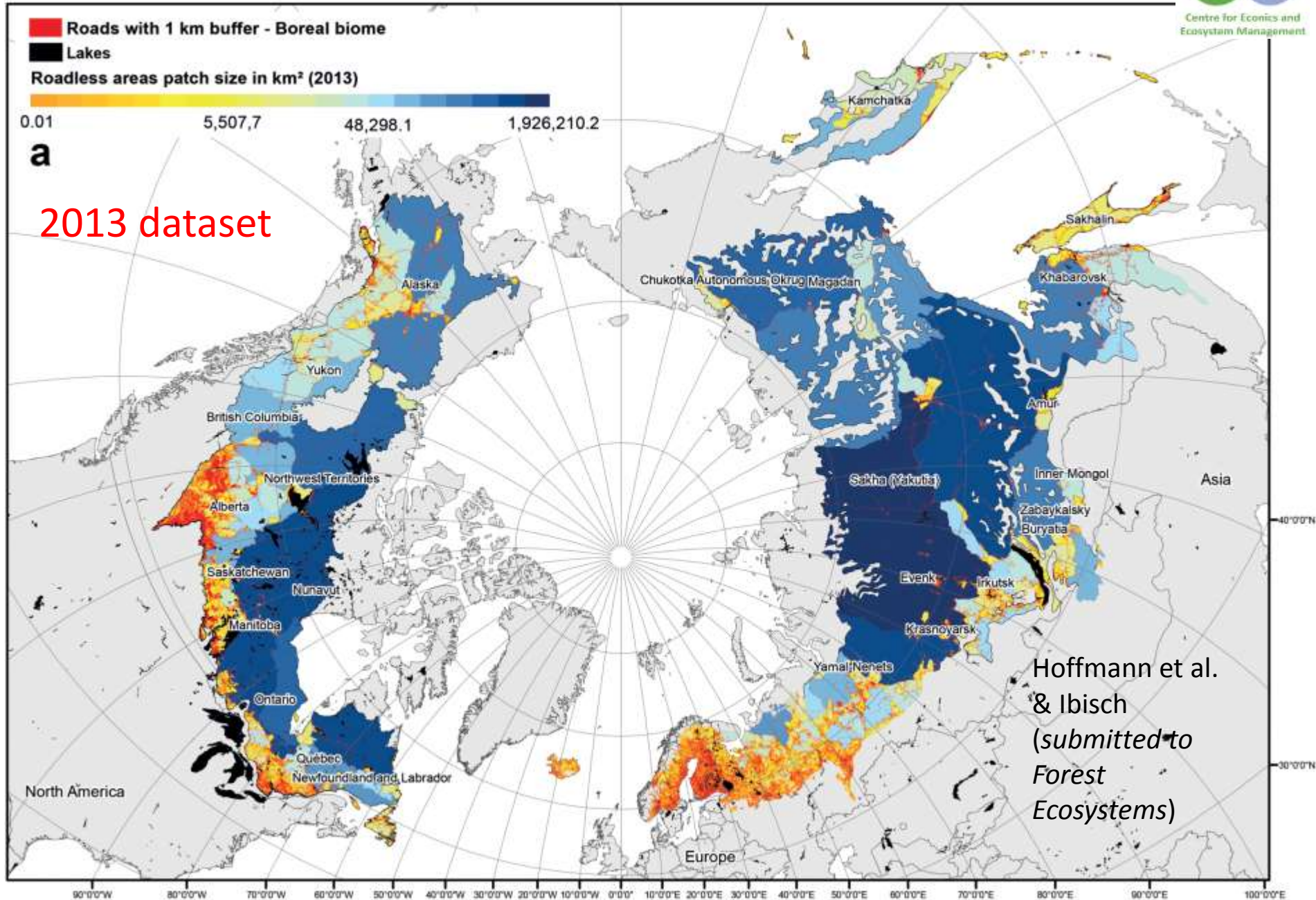
■ Lakes

Roadless areas patch size in km² (2013)

0.01 5,507.7 48,298.1 1,926,210.2

a

2013 dataset



Hoffmann et al.
& Ibisch
(submitted to
*Forest
Ecosystems*)

Boreal biome

■ Roads with 1 km buffer - Boreal biome

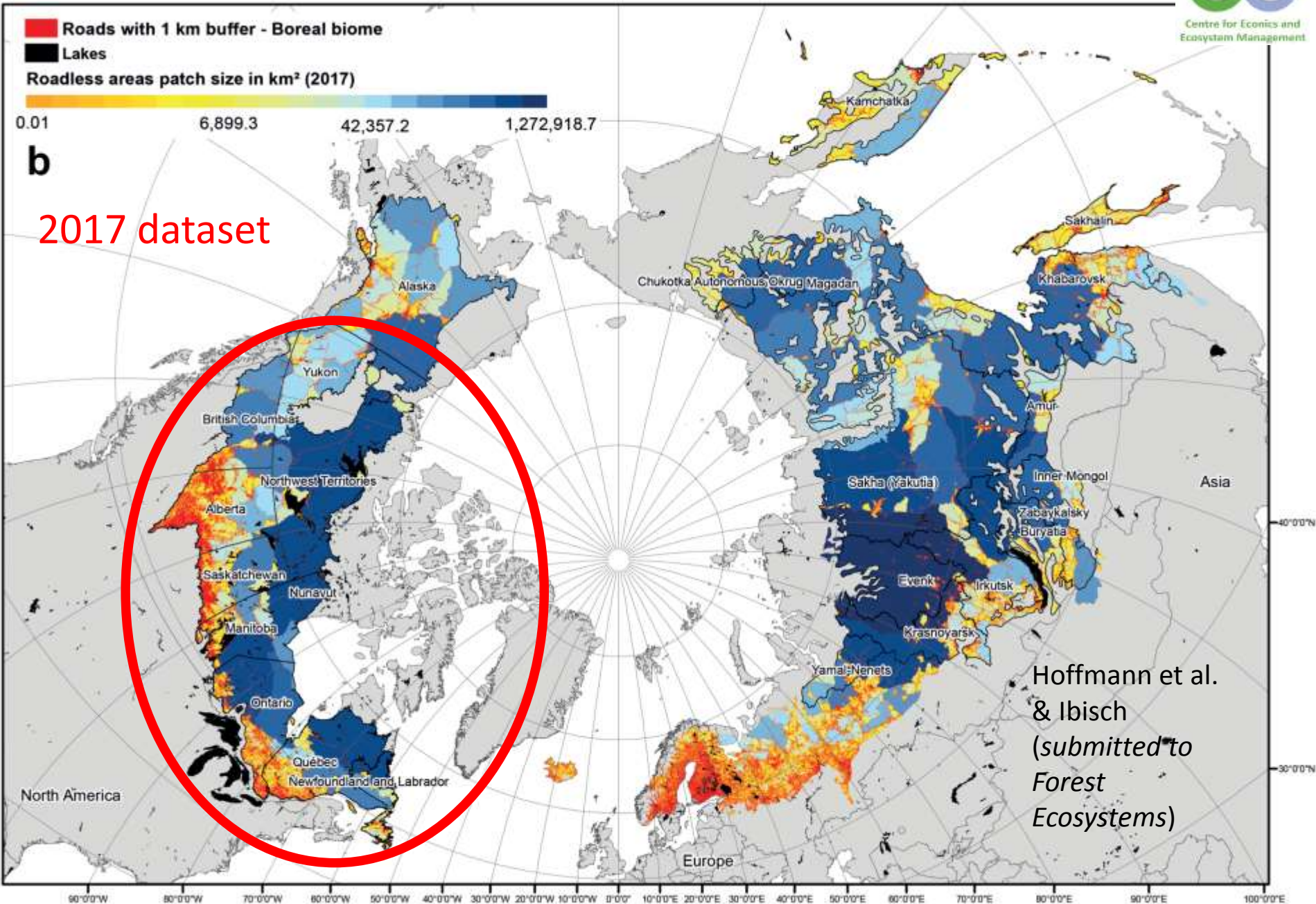
■ Lakes

Roadless areas patch size in km² (2017)

0.01 6,899.3 42,357.2 1,272,918.7

b

2017 dataset



Hoffmann et al.
& Ibisch
(submitted to
*Forest
Ecosystems*)

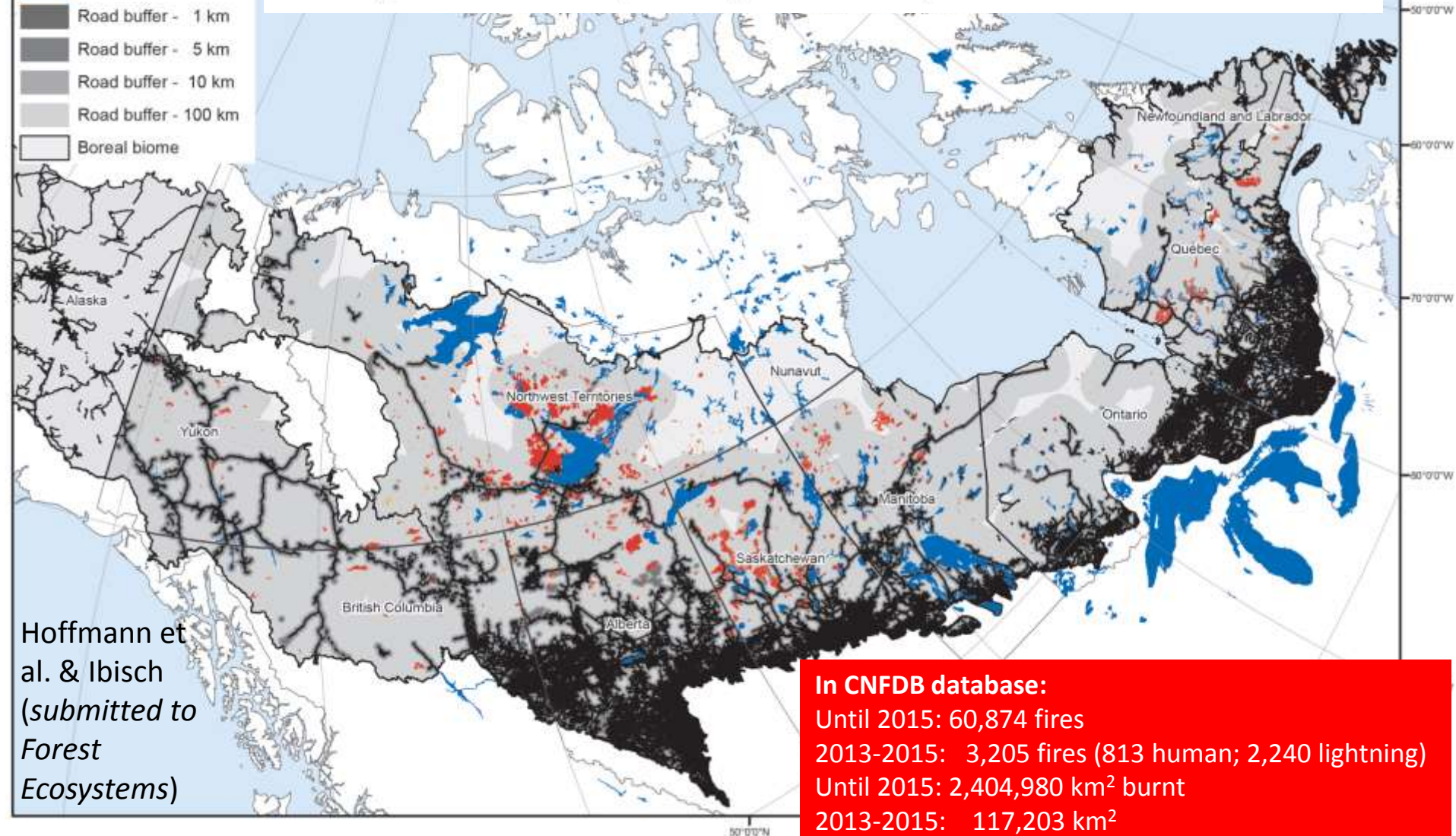
Boreal Canada



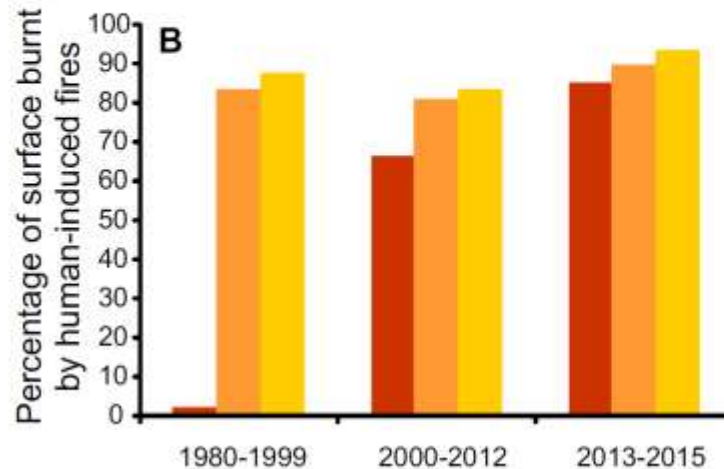
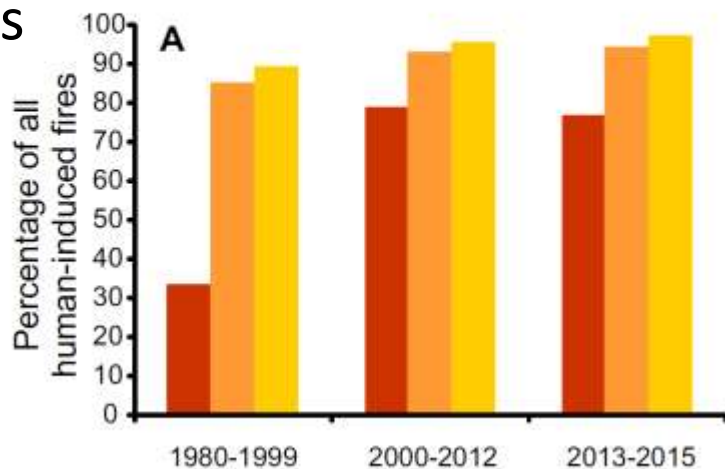
Recent fires (2013-2015) in boreal Canada (Canadian Forest Service 2016) and their location within different

buffers (1-km buffer represents 10.9% of boreal Canada, 5-km buffer 27,5%, 10-km buffer 35,2%, 100-km

buffer 87%), non-fire tree cover loss (2013-2015) (Hansen et al. 2013)






Boreal Canada - fires



Human-induced

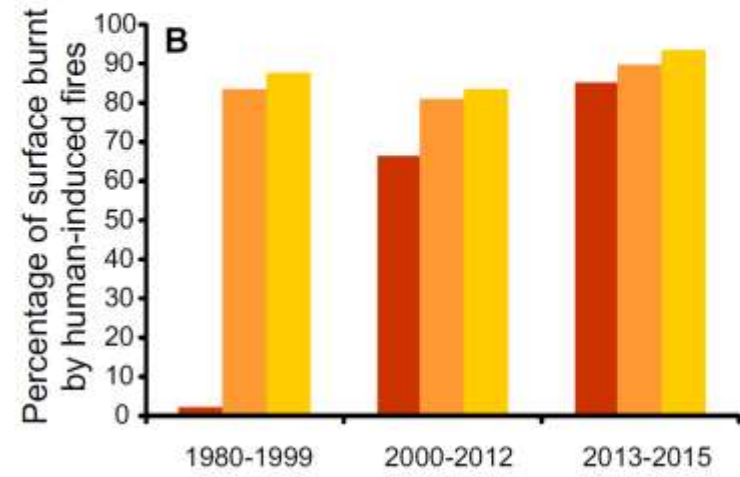
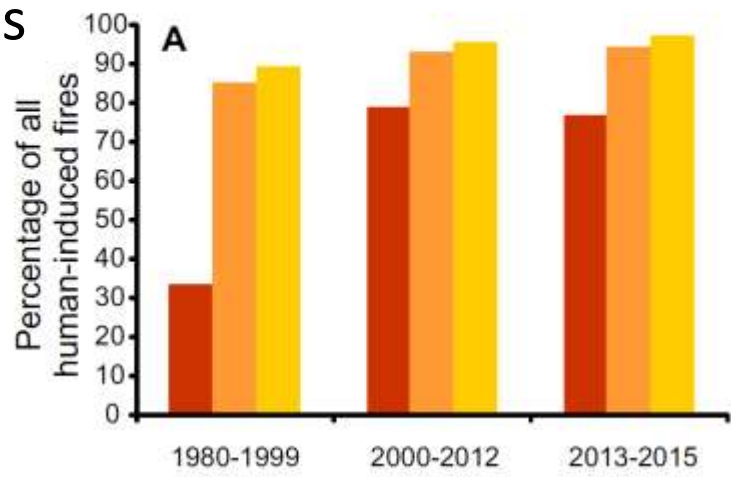


 1-km buffer	 5-km buffer	 10-km buffer
10.9%	27.5%	35,2%
of territory		

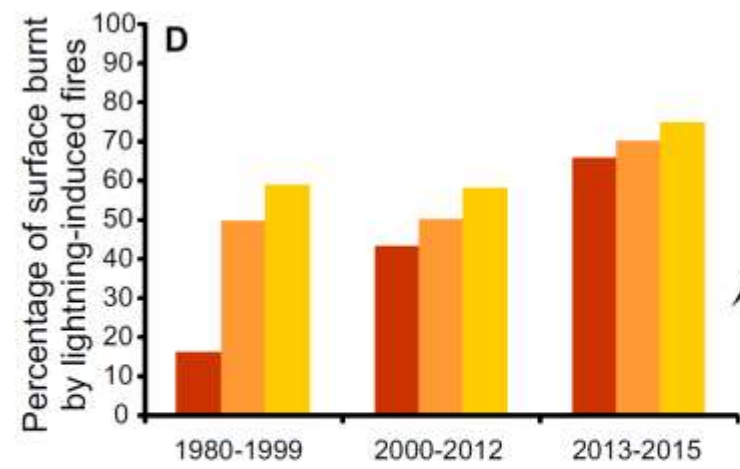
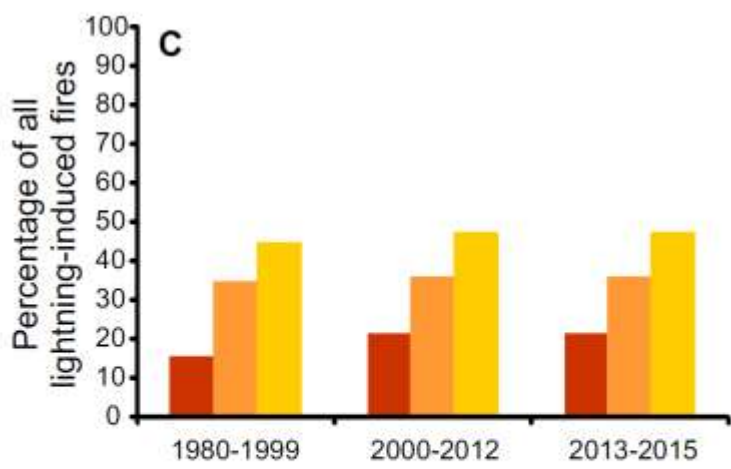
Hoffmann et al.
& Ibisch
(submitted to
Forest Ecosystems)

Boreal Canada - fires

% surface burnt



Human-induced



Lightning-induced

1-km buffer
 5-km buffer
 10-km buffer

10.9%

27.5%

35,2%

of territory

Hoffmann et al.
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Discussion and conclusions - data

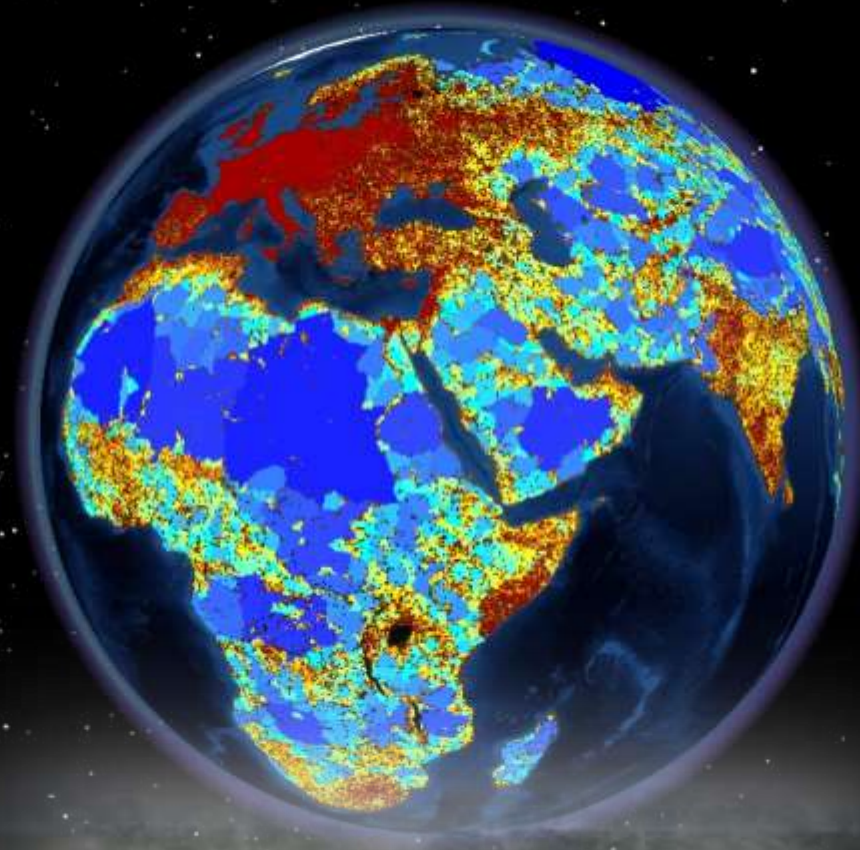
- Data quality for many regions not satisfying, but rapidly improving
- Importance of crowd-sourcing (OpenStreetMap)
- Need for (automatized) dynamic monitoring of roadless areas and their status
- Potential of GFBI for comprehensive assessment of global roadless forests

Discussion and conclusions - ecology

- Special vulnerability of forests to roads
- ‚Roadless ecology‘: Roadless forests stabilize the functionality of forest ecosystems: (micro)climate, anthropogenic and (!) natural fires, contagious effects ... [*What are roadless forests doing better, and how much?*]
- Climate relevance: carbon sequestration/storage and buffering capacity

Discussion and conclusions — conservation policy

- Roadless forests are lost rapidly
- The last chance to create Roadless Mega-Reserves in the Amazon and the boreal forest
- Responsibility of just a very few countries
- Applied research questions:
 - Alternatives to road-dependent mobility?
 - How to use forests without building roads?



www.roadless.online

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