IMPROVING LAND COVER PRODUCT-BASED ESTIMATES OF THE EXTENT OF FRAGMENTED COVER TYPES

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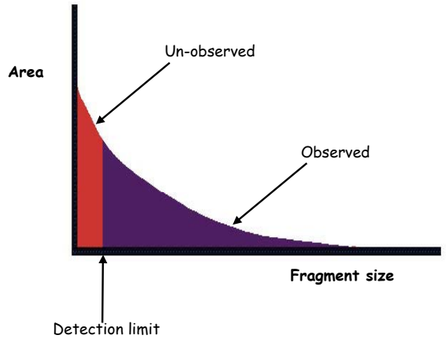
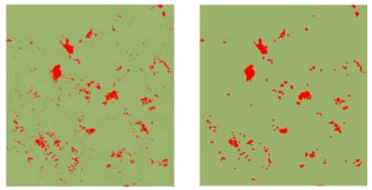
The effects of changing land use/land cover on regional and global climate ecosystems depends on accurate estimates of the extent of critical land cover types such as Arctic wetlands and fire scars in boreal forests. To address this information requirement, land cover products at coarse spatial resolution such as Advanced Very High Resolution Radiometer (AVHRR) -based maps and the MODIS land cover product are being produced. The accuracy of the extent of highly fragmented cover types, such as fire scars and ponds, is in doubt. Most fragments that are smaller than pixel size are missed and these are typically more numerous than those that are mapped, leading to area underestimation. A promising **method for improving areal estimates** involves modeling the observed distribution of the fragment sizes as a type of truncated distribution, then estimating the sum of unobserved sizes in the lower, truncated tail and adding it to the sum of observed fragment sizes. The method has been tested with both simulated and actual cover products.



Fragment sizes are identified using connected clumps of pixels. Fragment size distributions are modeled as either fractal (aka power or Pareto) or lognormal where selection of one or the other model is made using quantile-quantile plots. The algorithms for computing the estimates make use of standard probability theory (Maxim & Harrington, 1982; Hlavka & Dungan, 2002).

The method was tested with three data sets and results are summarized in the tables below. For coarse resolution maps, 'raw' statistics (pixel count * pixel area and numbers of fragments) are in **blue**, and adjusted estimates using the experimental method are in ***green***. These may be compared with statistics from relatively fine resolution maps derived from Landsat imagery in **red**.

Landsat TM 'MODIS'



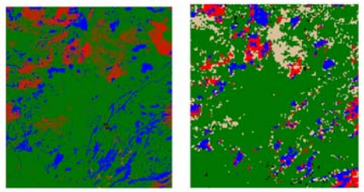
BRAZIL CENTRAL PLATEAU: FIRE SCARS IN THE CERRADO

		area (ha) fragments ≥ 6.25 ha	area (ha) all fragments
Brasilia N. P. 9/86	Landsat map*		34,960
	'MODIS' map**	28,744	*32,739*
Chapada N. P. 7/92	Landsat map*		134,563
	'MODIS' map**	117,419	*129,255*
Brasilia N. P. 7/92	Landsat map*		58,546
	'MODIS' map**	39,687	*44,656*
Chapada N. P. 7/92	Landsat map*		60,828
	'MODIS' map**	29,912	*48,913*

*fire scar maps provided by the U.S. Forest Service (Phil Riggan)
**simulated by spatial degradation of Landsat map

Results indicate that the new method can substantially correct underestimation of the extent of fragmented cover types at coarse resolution (e.g. AVHRR or MODIS). Underestimation can be as much as a third or more of the actual (finer resolution) area. The *adjusted estimates* are closer to Landsat estimates than the original estimates based on coarse-resolution imagery. The method might also be extended to correct for overestimation of dominant cover types and exaggerated portrayal of ecotone gradients on coarse resolution maps.

Landsat TM AVHRR

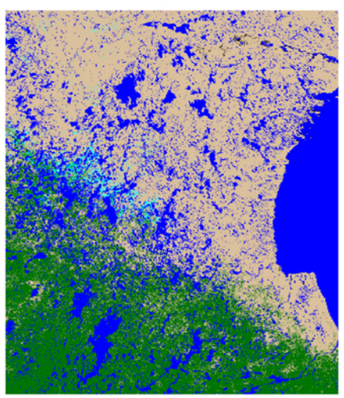


BOREAS: RECENT FIRES IN THE CANADIAN BOREAL FOREST

	area (ha) fragments ≥ 100 ha	area (ha) all fragments	number fragments ≥ 100 ha	number all fragments
Landsat TM fires*	672,500	1,076,000	542	650,331
AVHRR 92 fires**	728,700	*1,120,200*	1,102	*108,805*

*BOREAS follow-on DSP-1 TM land cover mosaic of the BOREAS Transect (PI Josef Cihlar), subset north of 54°N within 91/92 part of TM mosaic
**BOREAS 1-km seasonal land cover classification (PI Louis T. Stayeart), subset same area as for TM mosaic

MODIS



CANADIAN NW TERRITORIES: MODIS LAND COVER PRODUCT*

	area (ha) fragments ≥ 100 ha	area (ha) all fragments	number fragments ≥ 100 ha	number all fragments
wetlands	890,400	*1,225,043*	3,407	*90,274*
open water	16,320,400	*17,147,628*	11,142	*90,704*

*Provisional MOD12Q1 product for 10/15/00-10/15/01 provided by Boston University (PI Alan Strahler)

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