

Appendix 1 – Remote sensing of fires

The objective of the analysis of fires in the Dedoplistskaro valley were two fold: 1) To characterise in time and space the fire regimes in the Shiraki valley and Dedoplistskaro municipality over the last 16 years; and 2) To provide monthly and yearly estimates of cropland (agricultural land) area burnt for input into the future projections of fires to support the economic valuation study. In the following, we present the main figures from the analysis as well as information about where the data came from and how it was generated.³²

Agricultural fire intensity and extent within the Dedoplistskaro district 2000 to 2015

Figure A1.1 shows the number of times a given pixel-area within the Dedoplistskaro district has burned over from 2000 to 2015. The zone in which there is fire activity is aligned with the boundaries of the Shiraki valley. Most places within this zone has

burned 2–3 times over the past 16 years but there are some hotspots that have burned up to 8 times over the last 16 years.

Figure A1.2 shows the average number of hectares burned per month between January and December for the last 16 years, the standard deviation and the 95 per cent confidence interval for the mean.³³ Fire activity begins in May, but the end of July and early August is the time where fire activity peaks with an average of 3,000 ha burned per year.

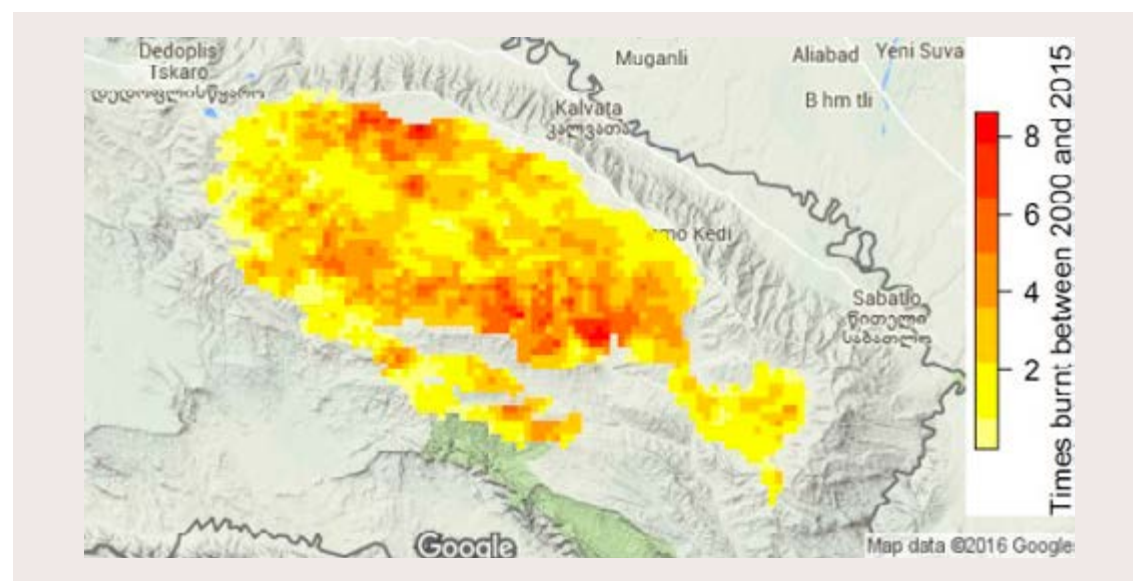
Figure A1.3 shows the share of grassland burned vis-à-vis cropland for the year of 2002 to 2014. In general, burning of cropland represents a larger share (from 50 to 80 per cent) of fires recorded by MODIS relative to grassland (from 10 to 40 per cent) in any one year.

Figure A1.4 shows the total area burned in Dedoplistskaro municipality as a whole and for the Shiraki valley between 2002 to 2014. The fig-

FIGURE A1.1

Fire intensity within the Dedoplistskaro district between 2000 to 2015

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³² The data and figures provided in this section have been elaborated by Luis Costa, an Altus Impact associate.

³³ There is a 95% certainty that the true population mean (burned area) lies within the indicated light grey zone.

ure shows that fire in the Shiraki valley account for the vast majority of fire activity in Dedoplistskaro municipality. This is in accordance with the previous figure, showing that the majority of fires recorded are on cropland.

Background on data and methods used for the analysis of fires

The above shown fire analysis for the Shiraki valley and Dedoplistskaro municipality was conducted using the datasets summarised in Table A1.1 as the main inputs.

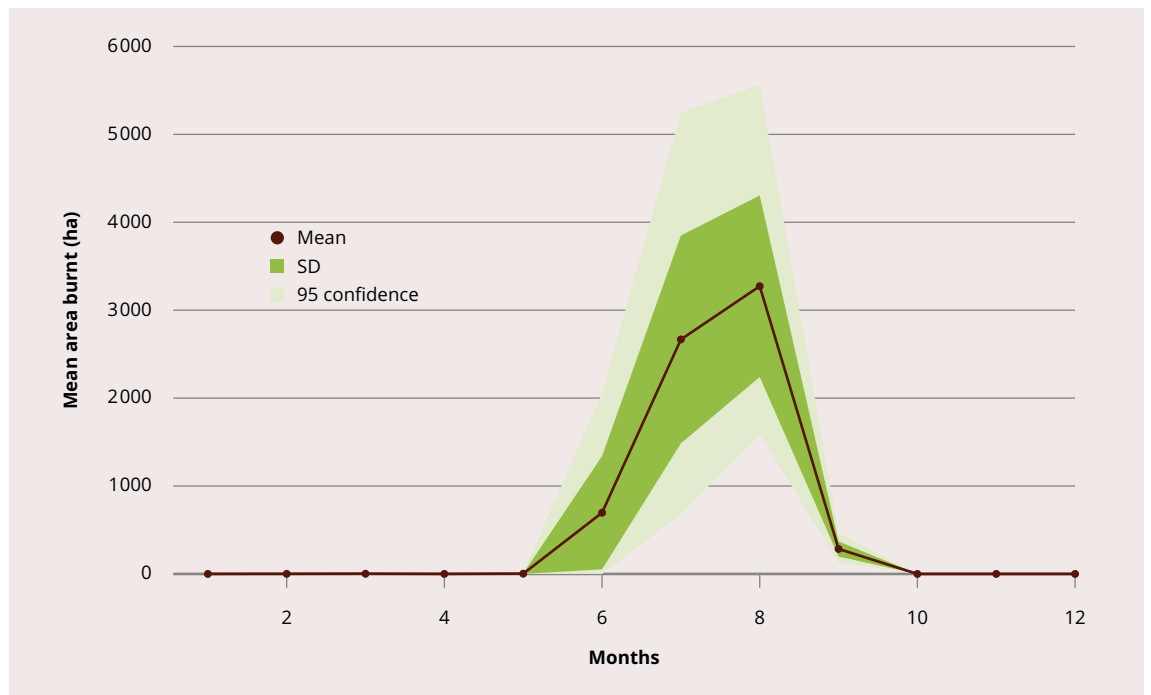
Unless noted otherwise, all spatial analysis was conducted with the R free software³⁴ environment for statistical computing. The first step of the analysis consisted in extracting the information from both MODIS products for the regions of interest. Accordingly, the geographic delimitation of the Dedoplistskaro district and the Shiraki valley was overlaid with the raster’s containing information of area burnt and land-cover, this was done for all the time series that were available (2000–2015). The end result of this process is two time series of raster data for each investigated location. The time series

of area burnt is composed by a total of 192 raster files, each representing one month (16 years x 12 months), and containing the dates of burning. The time-series of land cover is composed by 12 raster files (2001–2013), each containing the land-cover classification for the respective year.

Area burnt estimates are obtained by summing all pixels identified as “burnt” in the raster time series according to the respective day of burning. For example, all pixels coded with 1 (one) in the time series are summed up in order to obtain the total area burnt (over the 16 years of data) for the first of January. The process is repeated for all days of the year (1–365 days). Fires occurring in leap-days (February) are ignored. The monthly and yearly estimates of area burnt are simply obtained by corresponding aggregation of the daily results previously described. So far these results refer to the total area burnt in the two regions analysed. In order to distinguish fires taking place in cropland from others taking place elsewhere (see Objective 2), the raster depicting area burnt were overlaid with the raster files containing information on land-cover. Given the differences in time resolutions (monthly vs. annual) of the data sets the following assumption was made: area burnt as cropland in year x is deter-

FIGURE A 1 . 2

Bootstrapped distribution of average area burned by calendar month within the Shiraki valley (average over 2002–2015)



³⁴ <https://www.r-project.org/>

FIGURE A1.3

Fraction of total burned area by land use category by year

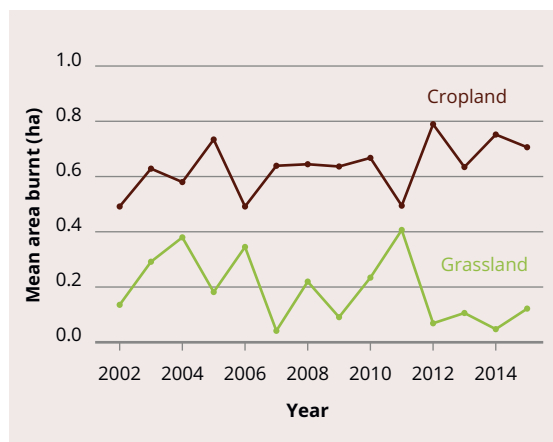
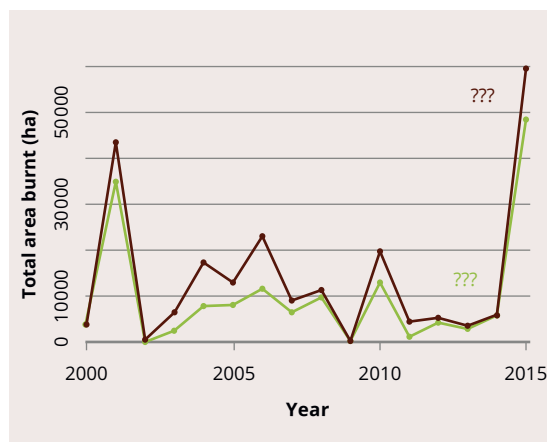


FIGURE A1.4

Total area burned in Shiraki and Dedoplistskaro per year



mined using the land-cover information of year x-1. For example, we assess the area burnt of cropland in the year 2001 using the land-cover information of the year 2000. This is done to establish a time buffer for the vegetation to re-establish itself from the fire season taking place the previous year.

Finally, a fire density map is also produced for the Dedoplistskaro district and the Shiraki valley. The map was obtained by counting how many times the same pixel was identified as burned in the MODIS dataset between 2000 and 2015.

TABLE A1.1

Overview of the input data used for the fire analysis in the Dedoplistskaro district and Shiraki valley

Information	Time frame	Type	Spatial resolution	Time resolution	Source
Delimitation of the Dedoplistskaro district	Present	Shapefile	-	-	Global Administrative Areas v2.5 ³⁵ retrieved in February 2016
Delimitation of the Shiraki valley	Present	Shapefile	-	-	Klein 2015, Satellite based fire-monitoring of 2015's burned area in Shiraki, Georgia, GIZ Report
Land cover (classes)	2001–2013	Raster	500m	Yearly	MODIS product MCD12Q1 ³⁶ retrieved in February 2016
Burnt area (date of burning per pixel)	2000–2015	Raster	500m	Monthly	MODIS product MCD45A1 ³⁷ February 2016

35 <http://www.gadm.org/>

36 https://lpdaac.usgs.gov/dataset_discovery/modis/modis_products_table/mcd12q1

37 https://lpdaac.usgs.gov/dataset_discovery/modis/modis_products_table/mcd45a1