yyyZZZZ_dfestimates.gdb README

The debris flow estimates geodatabase for fire yyy, during fire year ZZZZ, contains several feature classes:

All datasets are in UTM coordinates, Distance Unit = Meter, Angular Unit = Decimal Degree.

DISCLAIMER: The data included in this geodatabase may be preliminary in nature and have not received Director's approval. As such, these data are provisional and subject to revision. This information is provided with the understanding that revisions may be made, and conclusions drawn from such information are the sole responsibility of the user. Please see contact information below if you require additional information.

Feature Datasets

Relevant Feature Data:

yyyZZZZ_basinpt_feat: point feature class representing the basin outlets (pour points) used for calculating the basin-scale predictions.

yyyZZZZ_centroid: point feature class representing the geographic center of the fire perimeter.

yyyZZZZ_perim_feat: most recent burn perimeter, obtained from geomac.gov

yyyZZZZ_debrisbasins_feat: sediment retention structures located within or downstream of burn area. These data do not exist for every fire.

yyyZZZZ_dbstreams_feat: stream segments downstream or intersection sediment retention basins. These data do not exist for every fire.

Basin Scale Predictions:

yyyZZZZ_basin_df_predictions_2yr: Predictions at the basin scale for a 2 year recurrence interval rainstorm

yyyZZZZ_basin_df_predictions_5yr: Predictions at the basin scale for a 5 year recurrence interval rainstorm

yyyZZZZ_basin_df_predictions_10yr: Predictions at the basin scale for a 10 year recurrence interval rainstorm

yyyZZZZ_basin_df_predictions_25yr: Predictions at the basin scale for a 25 year recurrence interval rainstorm

yyyZZZZ_basin_df_predictions_50yr: Predictions at the basin scale for a 50 year recurrence interval rainstorm

yyyZZZZ_basin_df_predictions_100yr: Predictions at the basin scale for a 100 year recurrence interval rainstorm

Stream Segment Scale Predictions:

yyyZZZZ_segment_dfpredictions_2yr: Predictions at the stream segment scale for a 2 year recurrence interval rainstorm

yyyZZZZ_segment _dfpredictions_5yr: Predictions at the stream segment scale for a 5 year recurrence interval rainstorm

yyyZZZZ_segment _dfpredictions_10yr: Predictions at the stream segment scale for a 10 year recurrence interval rainstorm

yyyZZZZ_segment _dfpredictions_25yr: Predictions at the stream segment scale for a 25 year recurrence interval rainstorm

yyyZZZZ_segment _dfpredictions_50yr: Predictions at the stream segment scale for a 50 year recurrence interval rainstorm

yyyZZZZ_segment _dfpredictions_100yr: Predictions at the stream segment scale for a 100 year recurrence interval rainstorm

Tabular Information within Feature Classes

Within the basin and segment prediction feature classes listed above, the tables for each feature class provide the data used to make the calculations, as well as the calculated estimates of probability, volume, and combined hazard. Here is a description of the relevant fields within the table:

Southern California Model Data:

Basin_ID: unique basin identifier used in modeling (unique to these data only). Field is included only in the basin features.

Segment_ID: unique stream segment identifier used in modeling (unique to these data only). Field is included only in the segment features.

Relief: total upstream relief (m)

BSlp: Average slope of upstream burned terrain (%)

HM50Pct: Percentage of upstream area burned at high or moderate burn severity AND has gradient ≥ 50% (%).

CC: Average clay content of upstream area, from STATSGO dataset (in %).

SqRelief: square root of the total upstream relief, used in volume calcs (m)

LNHMKM2: natural log of the total upstream area burned at high and moderate severity (km)

PRain_XXyr: Average upstream minute rainfall intensity used for calculation probability estimates, where XX represents the recurrence interval of the rainstorm (e.g. PRain_10yr represents the 30-minute rainfall intensity for a 10 year recurrence interval rainstorm). Kean et al. (2013) and Staley et al. (2013) have identified that rainfall intensities measured over durations < 60 minutes are best correlated with debris-flow initiation. Statistical analyses of the probability dataset (Staley, D.M., unpublished data) confirm that rainfall intensities measured over 30 minutes provide the best statistical predictions when combined with the other metrics in a logistic regression equation. The volume and probability models were developed independently.

X_XXyr: x values used to calculate the probability of debris flow occurrence for recurrence interval storm 'XX' (see above), where:

$$x = -5.22 + (0.003 \times Relief) + (0.008 \times HM50Pct) + (0.024 \times BSlp) + (-0.007 \times CC) + (0.105 \times PRain\_XXyr)$$

ExpX_XXyr: e^x, used for calculating probability

P_XXyr: probability of debris-flow occurrence for recurrence interval storm of XX years, where:

$$P = e^x/(1 + e^x),$$

PCl_XXyr: Classifed probabilities, where 1 = 0-20%, 2 = 20-40%, 3 = 40-60%, 4 = 60-80%, 5 = 80-100%

Pcl_XXyr_Legend: field used to make probability layer legend.

VRain_XXyr: The square root of the average upstream 15-minute rainfall intensity used for calculation probability estimates, where XX represents the recurrence interval of the rainstorm (e.g. VRain_10yr represents the 15-minute rainfall intensity for a 10 year recurrence interval rainstorm). The rainfall intensity of 15-minutes was identified by Gartner et al. (Under Review) as being the best predictor of post-fire debris-flow volume. The volume and probability models were developed independently.

LNV_XXyr: natural log of the predicted volume for the design storm, calculated as:

$$\ln V\_XXyr = 3.10 + (0.17 \times SqRelief) + (0.30 \times LNHMKM2) + (0.49 \times VRain\_XXyr)$$

Volume_XXyr: predicted volume for the design storm, in m^3

VolMin_XXyr: lower confidence limit of the volume prediction for the design storm (based on -1 Standard Error)

VolMax_XXyr: upper confidence limit of the volume prediction for the design storm (based on +1 Standard Error)

VolCl_XXyr: Classifed volume predictions, where 1 = <1,000m^3, 2 = 1,000-10,000m^3, 3 = 10,000-100,000m^3, 4 >100,000m^3

VolCl_XXyr_Legend: field used to make volume layer legend.

CombHaz_XXyr: relative hazard ranking, where CombHaz_XXyr = VolCl_XXyr + PCl_XXyr

CombHazCl_XXyr: classified relative hazard ranking

CombHazCl_XXyr_Legend: field used to make combined hazard class legend

Intermountain West Model Data:

Rugged: Average upstream ruggedness, which is equivalent to the total upstream relief (m) divided by the square root of the total upstream area (m^2).

Slp30: The percentage of the upslope area with slope gradients in excess of 30 percent (%).

HMPct: The percentage of the upslope area that was burned at high or moderate severity. (%)

CC: Average clay content of upstream area, from STATSGO dataset (%).

LL: Average liquid limit of upstream area, from STATSGO dataset (%).

LnS30km2: Natural Log of the total upslope area with slope gradients in excess of 30% (km^2).

SqHMkm2: Square root of the total upslope area burned at high or moderate severity (km^2).

PRain_XXyr: Average upstream minute rainfall intensity used for calculation probability estimates, where XX represents the recurrence interval of the rainstorm (e.g. PRain_10yr represents the rainfall intensity for a 10 year recurrence interval rainstorm). Kean et al. (2013) and Staley et al. (2013) have identified that rainfall intensities measured over durations < 60 minutes are best correlated with debris-flow initiation. Statistical analyses of the probability dataset (Staley, D.M., unpublished data) confirm that rainfall intensities measured over 30 minutes provide the best statistical predictions when combined with the other metrics in a logistic regression equation. The volume and probability models were developed independently.

X_XXyr: x values used to calculate the probability of debris flow occurrence for recurrence interval storm 'XX' (see above), where:

$$x = -0.7 + (0.03 \times Slp30Pct) + (-1.6 \times Rugged) + (0.06 \times HMPct) + (0.2 \times CC) + (-0.4 \times LL) + (0.07 \times PRain\_XXyr)$$

ExpX_XXyr: e^x, used for calculating probability

P_XXyr: probability of debris-flow occurrence for recurrence interval storm of XX years, where:

$$P = e^x / (1 + e^x),$$

PCl_XXyr: Classifed probabilities, where 1 = 0-20%, 2 = 20-40%, 3 = 40-60%, 4 = 60-80%, 5 = 80-100%

Pcl_XXyr_Legend: field used to make probability layer legend.

VRain_XXyr: The square root of the average upstream rainfall accumulation used for calculation probability estimates, where XX represents the recurrence interval of the rainstorm (e.g. VRain_10yr represents the total rainfall accumulation for a 10 year recurrence interval rainstorm). The total rainfall accumulation was identified by Cannon et al. (2010) as being the best predictor of post-fire debris-flow volume. The volume and probability models were developed independently.

LNV_XXyr: natural log of the predicted volume for the design storm, calculated as:

$$\ln V\_XXyr = 7.5 + (0.7 \times SqHMKM2) + (0.6 \times LNS30KM2) + (0.2 \times VRain\_XXyr)$$

Volume_XXyr: predicted volume for the design storm, in m^3

VolMin_XXyr: lower confidence limit of the volume prediction for the design storm (based on -1 Standard Error)

VolMax_XXyr: upper confidence limit of the volume prediction for the design storm (based on +1 Standard Error)

VolCl_XXyr: Classifed volume predictions, where 1 = <1,000m^3, 2 = 1,000-10,000m^3, 3 = 10,000-100,000m^3, 4 >100,000m^3

VolCl_XXyr_Legend: field used to make volume layer legend.

CombHaz_XXyr: relative hazard ranking, where CombHaz_XXyr = VolCl_XXyr + PCl_XXyr

CombHazCl_XXyr: classified relative hazard ranking

CombHazCl_XXyr_Legend: field used to make combined hazard class legend

References:

Bonnin, G.M., Martin, D., Lin, B., Parzybok, T., Yekta, M., and Riley, D., 2006,Precipitation frequency atlas of the United States: Silver Spring, Md., National Weather Service, National Oceanic and Atmospheric Administration (NOAA) atlas 14, v. 1, version 5, accessed July 30, 2013, at http://hdsc.nws.noaa.gov/hdsc/pfds/.

Cannon, S.H., and DeGraff, J., 2009, The increasing wildfire and post-fire debris-flow threat in western USA, and implications for consequences of climate change, chap. 9 of Sassa, K., and Canuti, P., eds., Landslides—Disaster risk reduction: Springer, Berlin, p. 177–190.

Cannon, S.H., Gartner, J.E., Michael, J.A., Bauer, M.A., Stitt, S.C., Knifong, D.L., McNamara, B.J., and Roque, Y.M., 2007, Emergency assessment of debris-flow hazards from basins burned by the 2007

Canyon fire, Los Angeles County, southern California: U.S. Geological Survey Open-File Report 2007–1415, 1 sheet, at http://pubs.usgs.gov/of/2007/1415/.

Cannon, S.H., Gartner, J.E., Rupert, M.G., Michael, J.A., Rea, A.H., Parrett, C., 2010. Predicting the probability and volume of postwildfire debris flows in the intermountain western United States. Geological Society of America Bulletin 122, 127-144.

Gartner, J.E., Cannon, S.H., Santi, P., and Dewolfe, V., 2008, Empirical models to predict the volumes of debris flows generated by recently burned basins in the western U.S.: Geomorphology, v. 96, no. 3-4, p. 339–354.

Kean, J.W., Staley, D.M., Cannon, S.H., 2011. In situ measurements of post-fire debris flows in southern California: Comparisons of the timing and magnitude of 24 debris-flow events with rainfall and soil moisture conditions: J. Geophys. Res. 116, F04019.

Rupert, M.G., Cannon, S.H., Gartner, J.E., Michael, J.A., and Helsel, D.R., 2008, Using logistic regression to predict the probability of debris flows in areas burned by wildfires, southern California, 2003–2006: U.S. Geological Survey Open-File Report 2008–1370, 20 p., http://pubs.usgs.gov/of/2008/1370/.

Schwartz, G.E., and Alexander, R.B., 1995, Soils data for the conterminous United States derived from the NRCS State Soil Geographic (STATSGO) Database: U.S. Geological Survey Open-File Report 95–449, accessed July 2013, at http://water.usgs.gov/GIS/metadata/usgswrd/XML/ussoils.xml.

Staley, D.M., Kean, J.W., Cannon, S.H., Schmidt, K.M., and Laber, J.L., 2013, Objective definition of rainfall intensity—Duration thresholds for the initiation of post-fire debris flows in southern California: Landslides, v. 10, no. 5, p. 547–562.

Verdin, K.L., Dupree, J.A., and Elliot, J.G., 2012, Probability and volume of potential postwildfire debris flows in the 2012 Waldo Canyon Burn Area near Colorado Springs, Colorado: U.S. Geological Survey Open-File Report 2012–1158, 8 p., at http://pubs.usgs.gov/of/2012/1158/.

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