APPALACHIAN CITIZENS' LAW CENTER

INVESTING IN FLOOD RESILIENCE: A PERSPECTIVE FROM LETCHER COUNTY

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APPALACHIAN FLOOD RESILIENCE PRIORITIES

State & Local Capacity

Local governments are intended to be the first responders when disasters strike, however, many small towns in Appalachia do not have the funding or staff to adequately respond to flooding.

Low-Income Households

The cost to low-income communities during disaster recovery efforts are straining household budgets. Inability to recover after a natural disaster may lead to displacement, further exacerbating issues of population decline in Appalachian communities.

Flood Data and Mapping

Federal investments in flood mapping have not kept pace with the need or with increasing climate impacts; thousands of U.S. communities lack maps, and about 15 percent of community flood maps are over 15 years old.

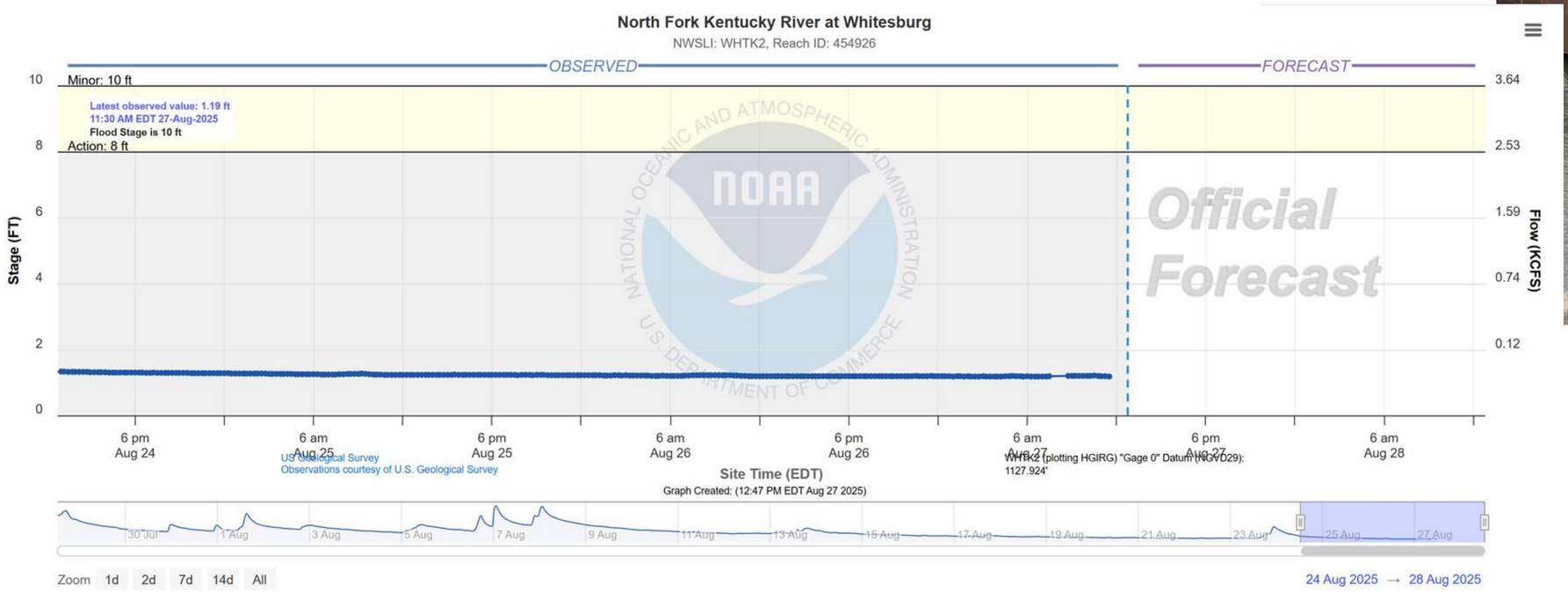
Nature-based Hazard Mitigation

Restoring and protecting the landscape, including via investments in nature-based solutions, are needed to better protect Appalachian communities, and to build long-term climate resilience.

STREAMGAUGES & FLOOD INUNDATION MAPS

STREAMGAUGES - WHAT DO THEY DO?

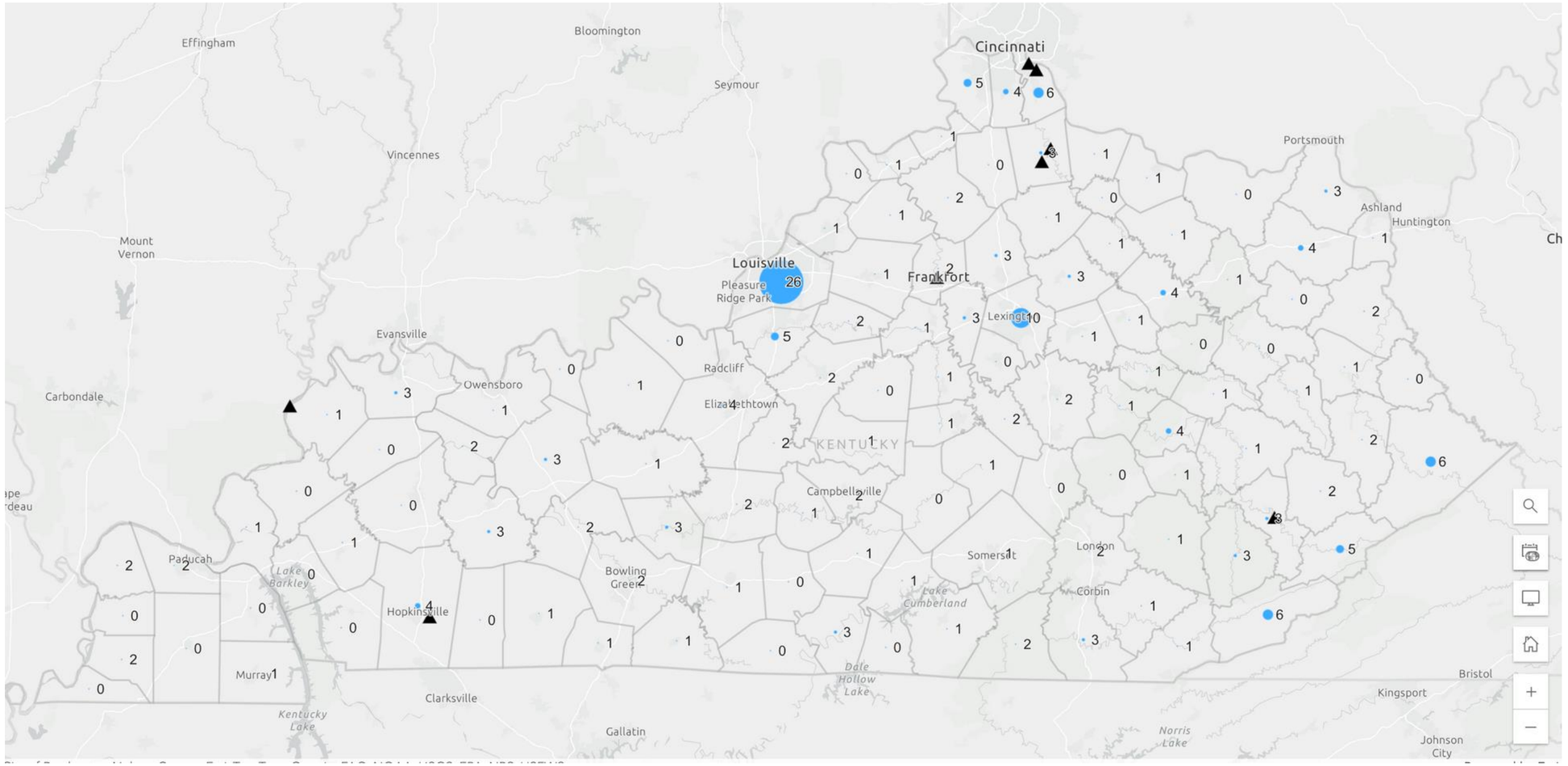
- **Alerts** – Flood alerts can be sent to nearby residents based on real-time data on river/stream height
- **Planning** – Provide data on streamflow conditions to build flood models, linking precipitation forecasts to gauge height forecasts



FLOOD INUNDATION MAPS

- Flood inundation maps (FIMs) model the area that will flood in correspondence with a specific gauge height
- To build an inundation map you need a gauge and a model calibrated to that gauge.
- These maps can assist emergency operations and planning

WHERE ARE STREAMGAUGES & FIMS?



Map created by Natalie Kruse Daniels, Ohio University

FUNDING FOR STREAMGAUGES AND FIMS

- Streamgauges and FIMS can be provided through USGS program funding. Typically communities are required to provide match funding. Communities can receive match funding through DLG's Flood Control Local match program.

- What do gauges and FIMs cost?
  - USGS streamgauge = $11-30k+ plus maintenance
  - USGS FIM = $200,000+

RECOMMENDATION #1: KENTUCKY FLOOD CENTER

Create a university-based flood center that receives annual appropriations from the legislature to deploy and maintain streamgauges, create flood inundation maps, and conduct research on flooding.

Model after the Iowa Flood Center: established in 2009 with an initial appropriation of $1.3M by the state legislature ($1,988,995 in today's dollars). FY25 appropriation was $1.2M.

- Iowa flood Center accomplishments to date:
  - Deployed over 300 gauges
  - Created over 30 flood inundation maps
  - Created a public interface that has been accessed over 5 million times

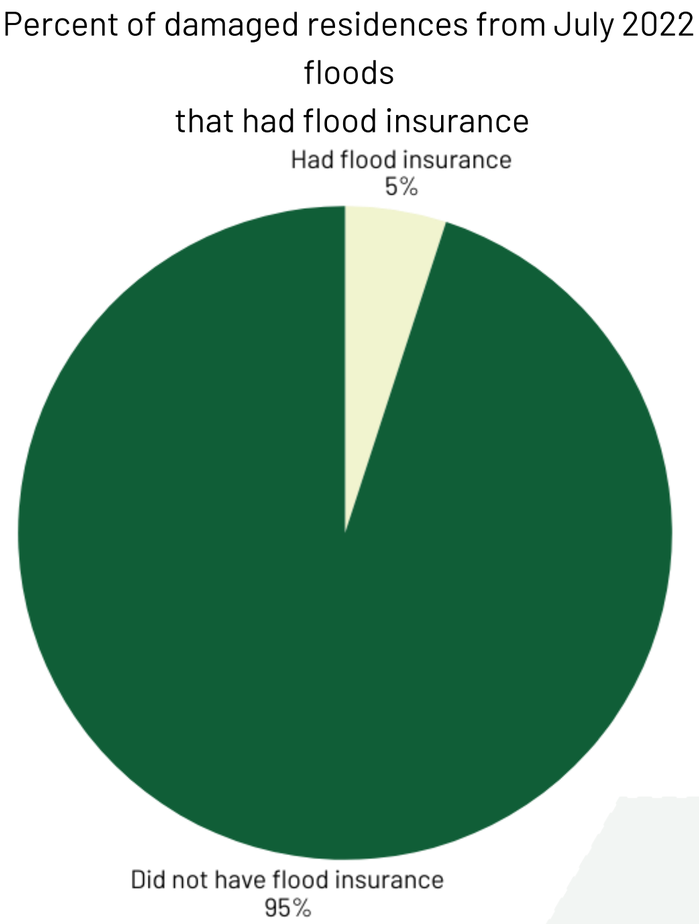
- In KY, a flood center could build on the interest and success of ongoing research in KY – the FLASH project is an NSF funded research project led by professors and UofL and is deploying gauges now in Letcher county. They have limited funding for just five years but with long-term support could maintain deployed gauges into perpetuity and expand the geographic region of their work.

A state flood center could provide technical support and capacity to the work of a state resilience office.

HOUSEHOLD RECOVERY & HAZARD MITIGATION CAPACITY

FLOOD INSURANCE IS INACCESSIBLE

- Flood insurance is expensive, premiums averaged $1,287 in 2024 for KY residents.
- There are only 18,300 NFIP holders in the state (July 2025)
- Only 5% of households impacted by the July 2022 floods had flood insurance
- Currently, in Letcher County, 14% of residential properties in the Special Flood Hazard Area have NFIP policies and 3% of all residential properties have NFIP policies



HOUSEHOLDS THAT RECIEVE FEMA AID MUST MAINTAIN NFIP

If a household receives FEMA Individual Assistance and is located in the SFHA, they are required to maintain flood insurance for impacted property; otherwise, **they will not** receive aid in the future.

This requirement is attached to the property, not the property owner.

LETCHER COUNTY

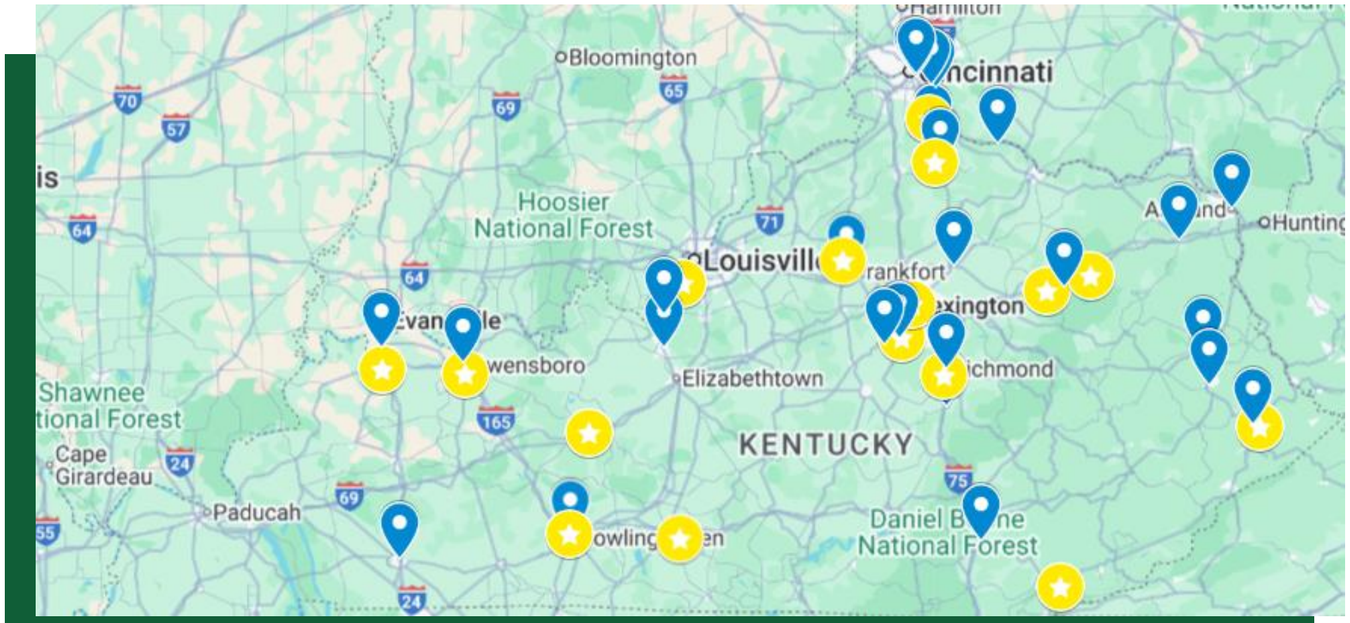
# of residences that received FEMA repair or replacement aid in 2022: **1,414** ($20.7M in aid)

# of residential structures in the SHA: over 1800

# of residences that currently have NFIP: **350**

Hundreds of residences unlikely to receive aid in the next flood

REDUCING HOUSEHOLD PREMIUMS THROUGH THE CRS



The Community Rating System (CRS) is a voluntary program within NFIP which encourages local governments to implement floodplain management practices exceeding minimum NFIP standards. Communities that participate in CRS receive discount flood insurance premiums for residents on a sliding scale, ranging from 5-45%.

Class 9 communities receive a 5% discount while Class 1 communities receive 45%.

There are only **43** CRS participating communities in KY and at least half are still just class 9 communities.

RECOMMENDATION #2: FLOODPLAIN MANAGEMENT MITIGATION GRANT FUNDING

Create a state-based mitigation fund to support local governments' participation in the CRS

Program would result in both improved floodplain management *and* decreased NFIP premiums for households

RECOMMENDATION #3: PROPERTY DISCLOSURE

Improve property disclosures to require that the seller must disclose whether the property has ever received federal disaster aid.

Under Kentucky's disclosure law, the Real Estate Commission has developed a mandatory disclosure form on which sellers must state whether:

- The property has ever had a flooding problem; and
- The residence is located within a special flood hazard area, and if so, what the flood zone is.

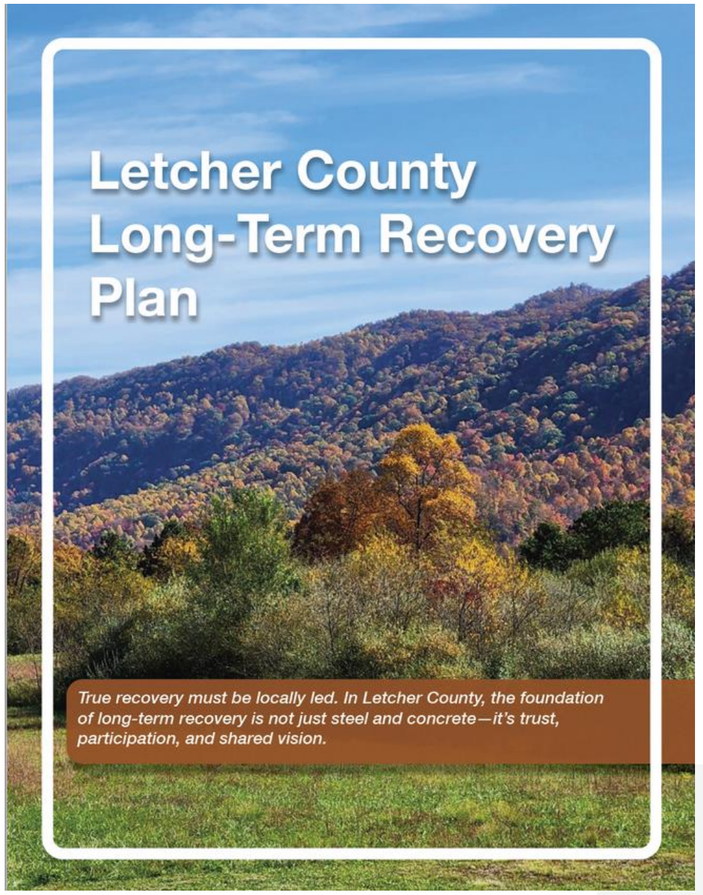
Currently, **8** states require that sellers disclose whether they have received aid from federal disaster assistance programs, including LA, MS, NC, NJ, NY, OK, SC, and TX.

LANDSCAPE-LEVEL NATURE-BASED HAZARD MITIGATION

FLOOD RISK EXACERBATED BY RESOURCE EXTRACTION

“The history of deforestation and coal mining in Letcher County has significantly impacted the environment. Extensive logging activities in the early 20th century led to deforestation, reducing the land’s ability to absorb rainfall. Additionally, coal mining operations have altered the natural landscape, creating conditions that increase the risk of flooding.”

-Letcher County Long Term Recovery Plan (pg. 14)



FLOOD RISK EXACERBATED BY RESOURCE EXTRACTION

"Lowering channel capacity decreases discharge and increases flood heights more than mountaintop removal, but mountaintop removal sites result in higher total discharge and operate as the **primary contributor to flood volumes** in the upper and lowermost portions of the watershed, highlighting a hydrologic sensitivity of the catchment to land use changes."

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Assessing the effects of anthropogenesis on Appalachian flood severity: An eastern Kentucky case study

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ABSTRACT

Flooding represents the complex interplay between drainage morphology, landscape hydrology, and precipitation. Precipitation patterns are influenced by interactions between atmospheric moisture circulation and topography, making steep Appalachian terrain vulnerable to extreme storms. Human activity alters surface hydrology and can exacerbate flooding of low-elevation areas where populations are densest. Mountaintop removal is a notable landscape change, but floodplains are also affected by construction of roads and other critical infrastructure and access limitations are addressed by reengineering river channels and building bridges. Though all of these may contribute to flooding, their relative importance remains equivocal. A July 2022 flood in eastern Kentucky provided the opportunity to validate a flood model incorporating major alterations to the landscape, then to iteratively test to determine which, if any, worsened flooding. While bridges, roads, and buildings had only minor effects on flooding despite their proximity to main channels and floodplains, discharge, flood height, and volume results were sensitive to channel narrowing and increased surface runoff facilitated by mountaintop removal sites. Lowering channel capacity decreases discharge and increases flood heights more than mountaintop removal, but mountaintop removal sites result in higher total discharge and operate as the primary contributor to flood volumes in the upper and lowermost portions of the watershed, highlighting a hydrologic sensitivity of the catchment to land use changes. Findings of this study serve to identify human-controlled factors most likely to contribute to future flooding and may thus inform mitigation efforts in eastern Kentucky and similar Appalachian catchments.

LOGGING AND LANDSLIDES

- After July 2022 floods, KGS identified 1000 landslides and debris flows associated with the event
- Studies show that landslides occur 3-9 times more often in logged vs. non-logged areas
- Landslides often occur years after logging has taken place, once roots have decayed
- Kentucky does not have Best Management Practices (BMPs) for logging steep slopes to reduce landslides and sediment flows

Forest clearing and regional landsliding

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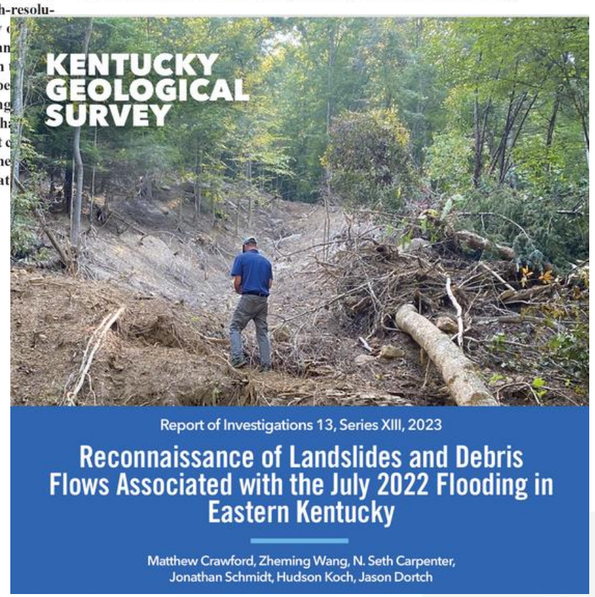
ABSTRACT

The influence of forest clearing on landsliding is central to long-standing concern over the effects of timber harvesting on slope stability. Here we document a strong topographic control on shallow landsliding by combining unique ground-based landslide surveys in an intensively monitored study area with digital terrain modeling using high-resolu-tion laser altimetry and a coarser resolution regional study landslides. As predicted by our digital terrain–based model, lan occur disproportionately in steep, convergent topography. In predicted to be at low risk of slope failure, a random model pe equally well to our mechanism-based model. Our monitoring that storms with 24 hr rainfall recurrence intervals of less tha triggered landslides in the decade after forest clearing and that tional monitoring programs can substantially underestimate the of forest clearing. Our regional analysis further substantiat

is variable and most studies cover only a single watershed, a situation that has contributed to variations in the reported influence of timber harvest on rates of landsliding. Here we combine comprehensive, ground-based mapping of postharvest landslides in a small watershed with a regional analysis to evaluate the relation of contemporary and longer term rates of landsliding.



RECOMMENDATION #4: BMPS FOR LOGGING ON STEEP SLOPES

Direct the Division of Forestry and Forestry BMPs Board to establish logging best management practices for steep slopes to help prevent landslides

- The Kentucky BMP document:
  - states that some slopes may be too steep to log,
  - recognizes the importance of retaining trees in some classes of sensitive areas, and
  - emphasizes that sinkholes—which are, like landslides, geologic features—need to be considered when planning logging operations.

- The BMP document **does not** provide guidance about the definition of “too steep” nor specifically have BMPs for landslide prevention.

RECLAIMING MINED LANDS TO IMPROVE HYDROLOGIC FUNCTION

- Mine land reclamation involves heavy compaction and soils are often thinner and finer-grained
- Consequently, reclamation can result in an almost “impervious” surface similar to those found in urban environments
- Reforesting mine sites reduces compaction and creates conditions that support the redevelopment of soils more similar to those that were there before mining

WATER RESOURCES RESEARCH, VOL. 45, W04407, doi:10.1029/2008WR007109, 2009

Surface mining and reclamation effects on flood response of watersheds in the central Appalachian Plateau region

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Received 23 April 2008; revised 14 January 2009; accepted 9 February 2009; published 7 April 2009.

[1] Surface mining of coal and subsequent reclamation represent the dominant land use change in the central Appalachian Plateau (CAP) region of the United States. Hydrologic impacts of surface mining have been studied at the plot scale, but effects at broader scales have not been explored adequately. Broad-scale classification of reclaimed sites is difficult because standing vegetation makes them nearly indistinguishable from alternate land uses. We used a land cover data set that accurately maps surface mines for a 187-km^2 watershed within the CAP. These land cover data, as well as plot-level data from within the watershed, are used with HSPF (Hydrologic Simulation Program-Fortran) to estimate changes in flood response as a function of increased mining. Results show that the rate at which flood magnitude increases due to increased mining is linear, with greater rates observed for less frequent return intervals. These findings indicate that mine reclamation leaves the landscape in a condition more similar to urban areas rather than does simple deforestation, and call into question the effectiveness of reclamation in terms of returning mined areas to the hydrological state that existed before mining

Citation: F
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Earth Surf. Process. Landforms (2020)

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Check for updates

Peripheral gully and landslide erosion on an extreme anthropogenic landscape produced by mountaintop removal coal mining

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GREEN FOREST WORKS SUCCESS STORY: GUY COVE VALLEY FILL (BREATHITT COUNTY)

2007

2009

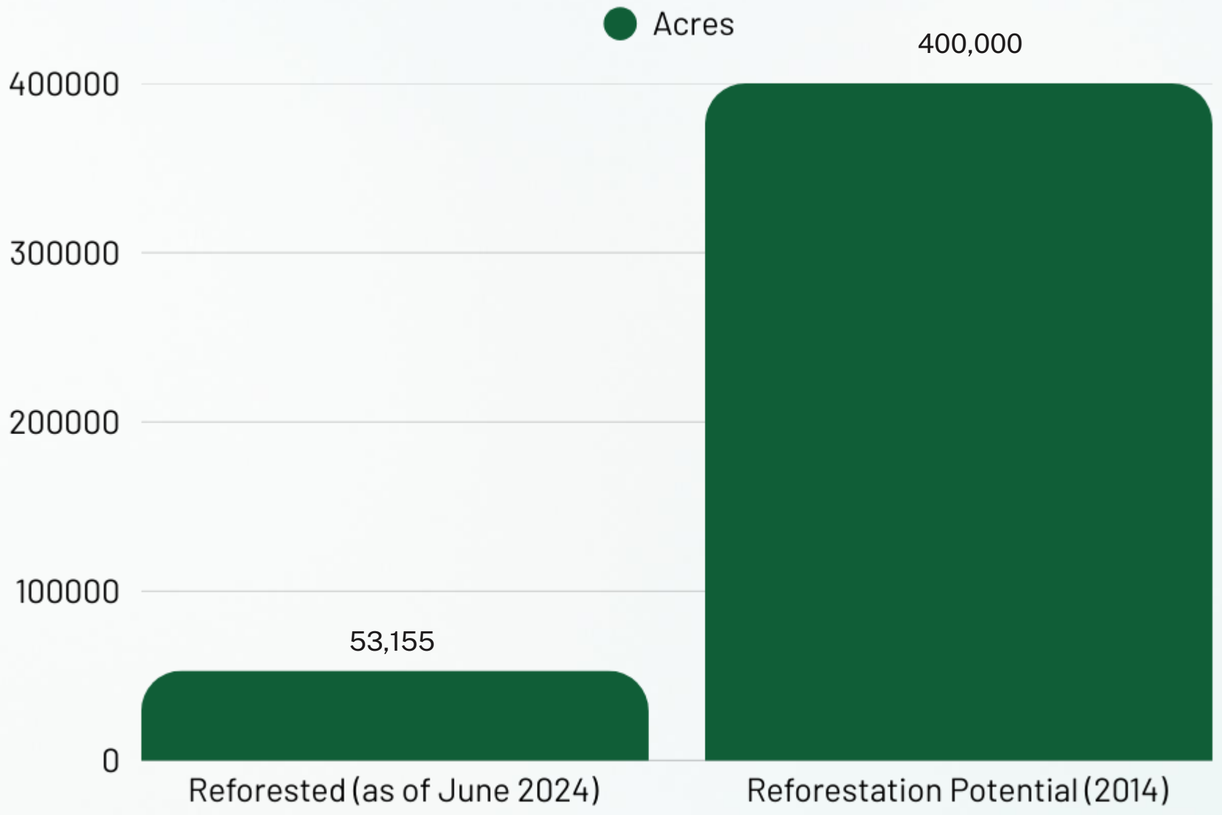
2019

Guy Cove valley fill was a mine site that buried a headwater stream and was reclaimed as a grassland. The restoration focus was two-fold: reforest the landscape and restore the stream. They dug in a stream and connected it with a stream in a nearby, unmined site and planted 60,000 trees.

APPALACHIAN REGIONAL REFORESTATION INITIATIVE

KY Acres Reforested

Over 53,000 acres reforested by ARRI partners as of June 2024



RECOMMENDATION #5: SUPPORT REFORESTATION EFFORTS ON PREVIOUSLY MINED LANDS

Create a state fund to support reforestation of previously mined lands

- There are no dedicated federal funds for reforesting mine lands
- ARRI partners with state and federal agencies, corporations, and nonprofits to pull together funding. Two agencies with cost-share programs that can be used for reforestation and in partnership with ARRI are NRCS and FSA cost-share programs.

THANK YOU

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