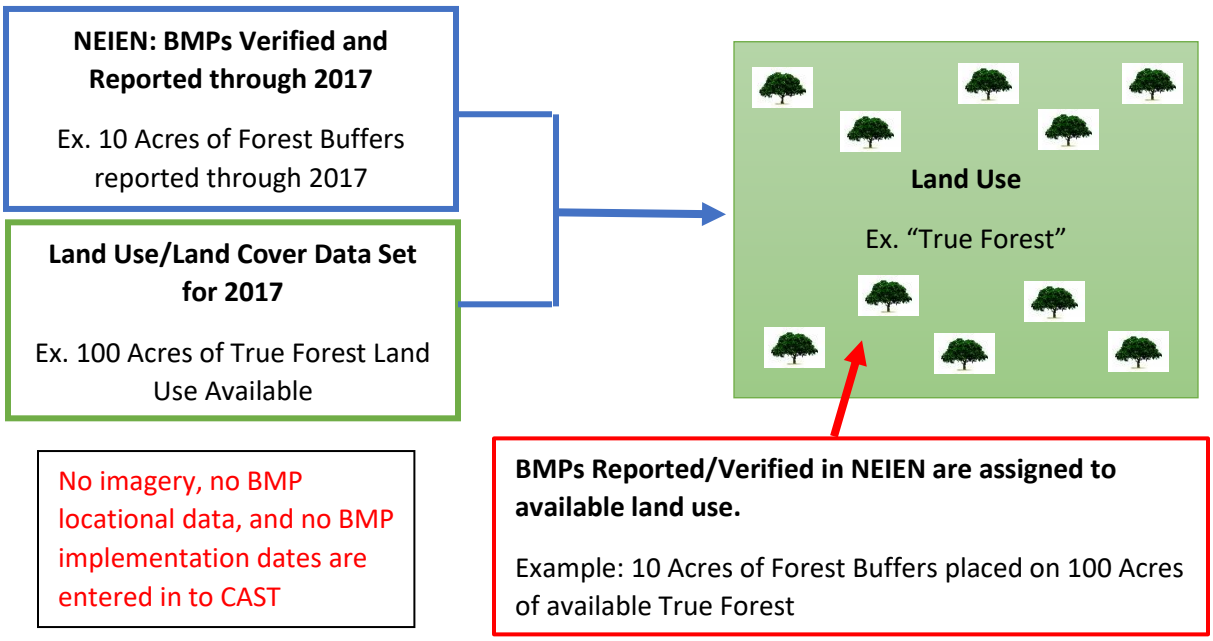
How Does Backout Work?

Backout is the subtraction of historic land use change practices from the practices reported on an annual basis.

Backout **only** applies to land use change practices and is recalculated for every new version of CAST. The CAST-19 model update included land use data from the 2017 Ag Census and updates from the CBPO Land Data Team. The CAST-21 model update will incorporate annual NASS data and the 2017 high-resolution land cover data update into our current land use dataset. The current land use dataset back casts to 1984 and forecasts to 2025 to create the base condition scenarios. The Ag Census data informs the agricultural land uses while the high-resolution land cover data informs the impervious cover, forested and tree canopy land uses. Combining all of the data sources, zoning data, NASS data, the Ag Census, high-resolution data, and other updates from the land data team, yields the land use data (1984-2025) that is incorporated into CAST with milestone model updates. [**BMP's are not used to develop the land use dataset.]

BMPs reported and verified by states through NEIEN up through the year of the land use [in the use/land cover data sources. The land use dataset/ high resolution land cover imagery **does not** detect specific BMPs.



The BMPs assigned to available land uses up to the year of the land use/land cover data (2017 Official Progress Scenario) are then backed out of the model. The 2012 base scenario backs out the 2012 BMP acres (from the official version of annual progress for that version of CAST), the 2013 base scenario backs out the 2013 BMP acres, up until the 2017 scenario backing out the 2017 BMP acres. After 2017, for 2018 and onward (until the next land use/land cover update),

the 2017 base condition reported acres/the 2017 official progress scenario (the historic land use change) will be backed out.

If the BMP is **only** a land use change BMP, once it is included in the backout, **the land use change** from a higher to lower loading source *is assumed to be represented* in the 2017 base conditions data, therefore, the BMP will be placed on the lower loading source and the land use change will no longer be given.

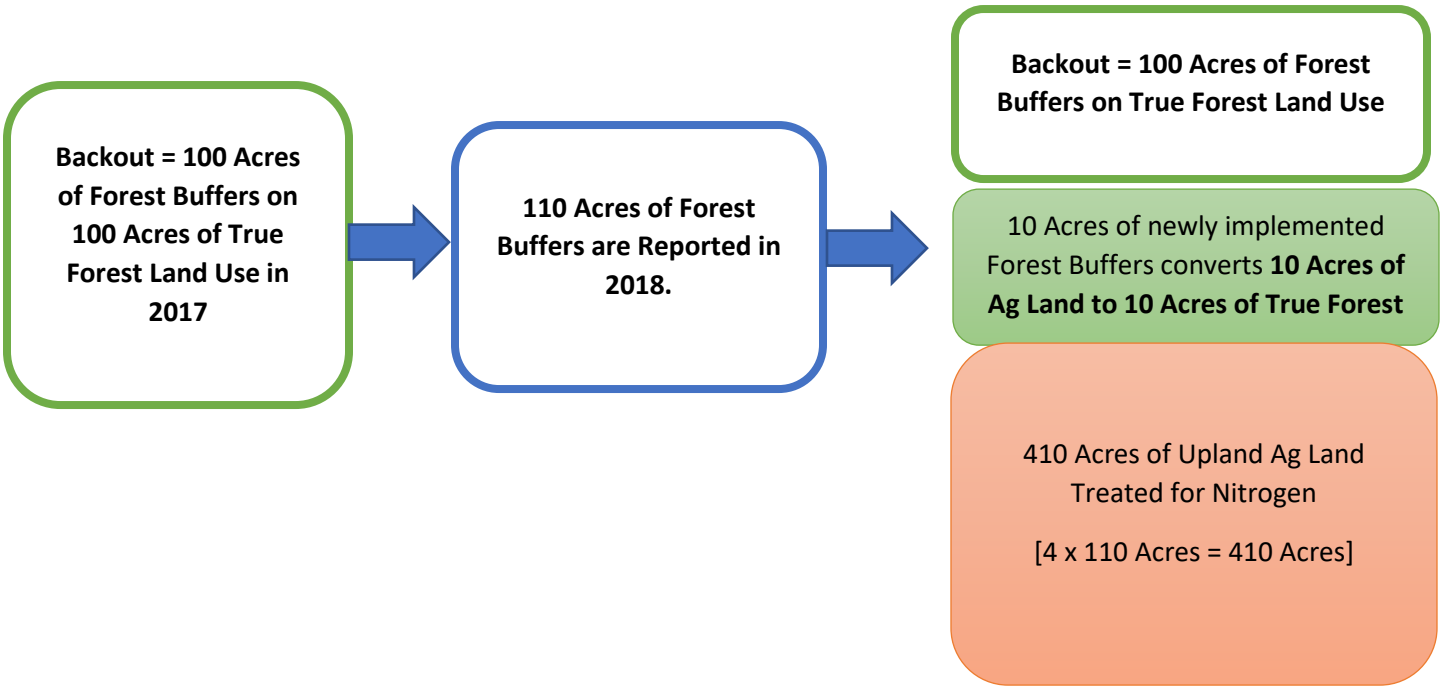
- For example, the Urban Forest Planting BMP is a land use change BMP that converts land uses to Forest. Once it is included in the backout, it will be considered "True Forest" and receive the loading rate that is assigned to the True Forest Land Use. Backout only applies to BMPs that are land use change BMPs.

If a BMP included in the backout is **a land use change practice that receives a nutrient efficiency (upland efficiency)**, like a Forest Buffer, the BMP will *continue to be given the efficiency* as the backout does not remove the efficiency (upland credit).

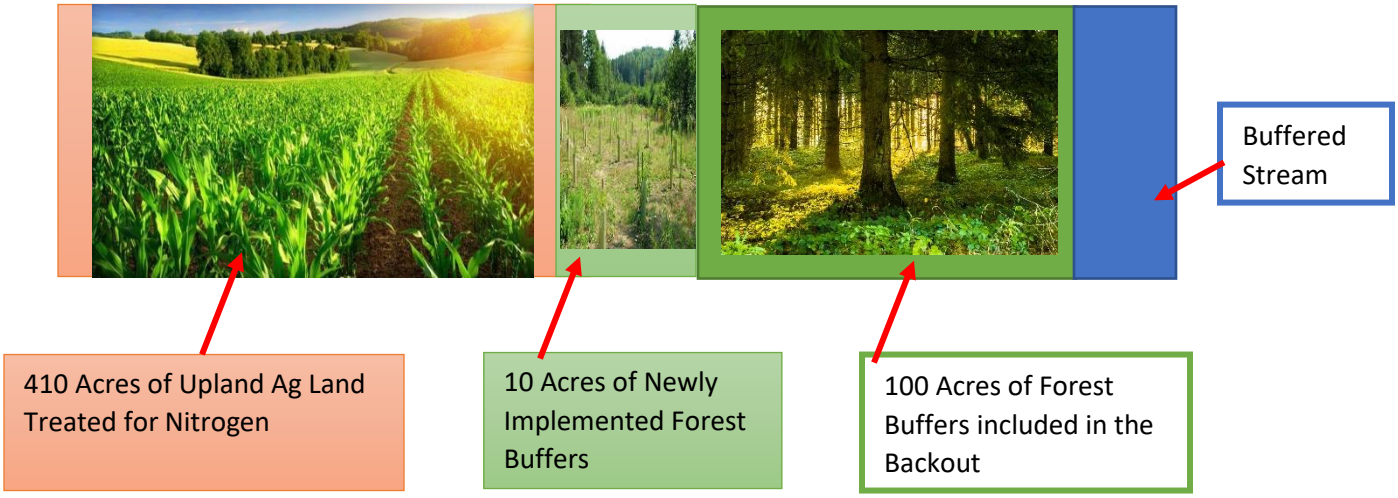
- (Nutrient Efficiency = Effectiveness Value = Upland Credit)

Backout was created to avoid double counting land use changes. The acres present in the land use/land cover data are used to create the initial land use (base condition) for a progress year scenario.

For Example, if 100 acres of Forest Buffers were verified and reported up to the land use/land cover date of 2017, those 100 acres would become the backout number for Forest Buffers. If 110 Buffers were reported in 2018, 100 acres would be included in the backout, while there would be 10 acres of new implementation. The 10 acres of new implementation would receive a land use change credit and an upland credit (efficiency). The 100 acres included in the backout would be assigned to the lower loading source of the "True Forest" land use (as opposed to an agricultural land use) would receive **only** an upland credit.



Land use change practices are cumulative, meaning the "credit" for these practices is not lost due to backout. When the land use change BMP is reported/verified, it will receive the land use change credit up until it is included in the backout with the incorporation of new land use/land cover data. Once it is included in the backout, the BMP will be represented as a lower loading source. While a large drop (load reduction) due to a land use change will no longer be observed, the implemented BMP will continue to contribute to lower loads by increasing the acreage of the land use with a lower loading rate. If the BMP receives a nutrient efficiency, that efficiency will continue to be observed regardless of the backout.



How Does Backout Work for Forestry Practices?

Forest Harvesting, assigned to the "Harvested Forest" land use, is not a land use change practice. Forest Harvesting **only** receives an efficiency value. Backout is only applied to land use change practices, therefore Forest Harvesting is not included in the backout.

Tree Planting, Forest Planting and Forest Buffers **are Land Use Change Practices**.

Forest Buffers, *including Forest Buffers with Exclusion Fencing*, differ from Tree Planting and Forest Planting in that it functions **not only as a land use change practice, but also an efficiency practice**. This means that, once the land use change is calculated, those acres also receive an effectiveness value, **also known as an upland credit.** Forest Buffers reduce the amount of nutrients delivered from upland acres as water carrying nutrients moves through the soil into the buffered stream.

Backout For Forest Buffers Example

An area has 100 acres of agriculture land uses and 60 acres of the "True Forest" land use. No Forest Buffers are on the land.

Pre-Forest Buffer BMP: 100 Acres of Untreated Agriculture Land and 60 Acres of True Forest

100 Acres of Untreated Agriculture Land

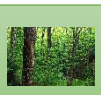
60 Acres of True Forest

Post-Forest Buffer BMP: Buffered Land Converted to the Forest Land Use and Treated Upland Agriculture Land Added to the Area

Ten acres of the Forest Buffer BMP are placed on the land. This means:

1) 10 acres of land are converted from the agriculture land uses to the True Forest land use, meaning 10 acres are converted from a higher loading source (Agriculture Land Uses) to a lower loading source (True Forest); and
2) An efficiency is applied to four times the reported buffer acreage for nitrogen and two times the reported buffer acreage for phosphorus and sediment.

10 Acres of Agriculture Land Converted to Forest



[10 Acres of Buffers x An Efficiency Value of 4 =]

40 Acres of Upland Agriculture Land Treated for Nitrogen

50 Acres of Untreated Agriculture Land

60 Acres of True Forest

10 Acres of Agriculture Land Converted to Forest

[10 Acres of Buffers x An Efficiency Value of 2 =]

20 Acres of Upland Agriculture Land Treated for Phosphorus and Sediment

70 Acres of Untreated Agriculture Land

60 Acres of True Forest

For **Developed Land**, the reported buffer acreage equals the upland area treated for nitrogen and phosphorus. (1:1 ratio, one acre of buffer receives one acre of upland credit for N,P,S)

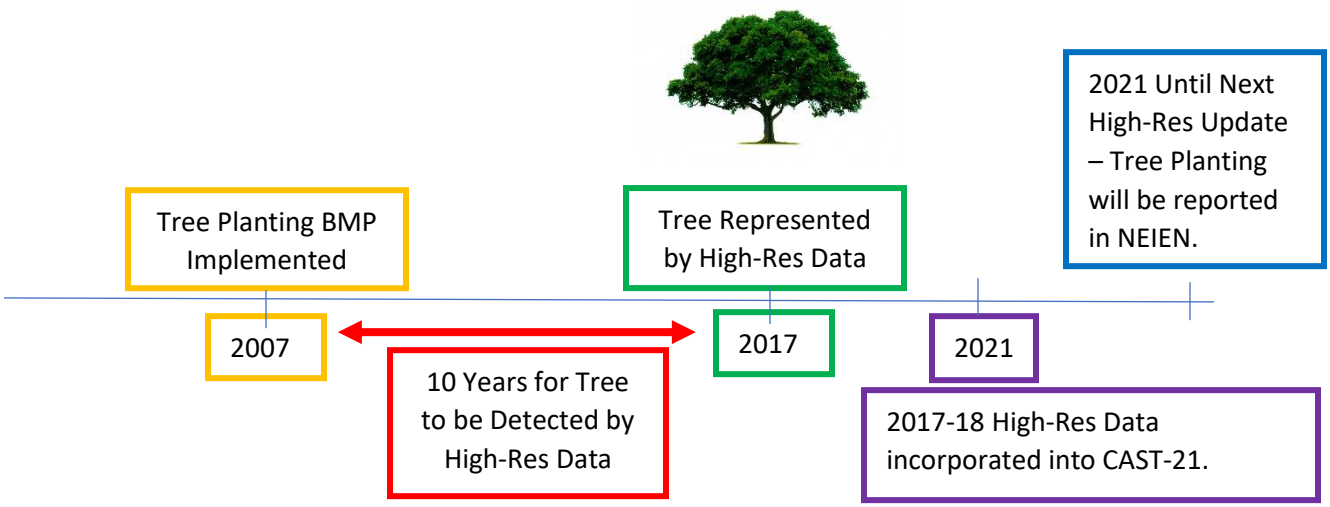
Verification and Re-verification

Forest Buffers verified and included into the backout **will still receive the upland credit** (or efficiency). *From the example*, once the 10 Acres of Forest Buffers are included into the backout number, they will no longer get the land use change credit for converting agriculture land to forest (since these additional forest acres are now included in the base condition land use/the backout number), but would continue to receive the upland credit for treating 40 acres of land for nitrogen and 20 acres of land for phosphorus and sediment.

Forest Buffers included in the backout will remain in the backout until the next time the land use/land cover imagery is updated and the backout is recalculated. Therefore, when the land use/land cover data is updated, Forest Buffers will need to be reverified and reported if they have surpassed their credit durations for incorporation into the next land use/land cover update and backout calculation.

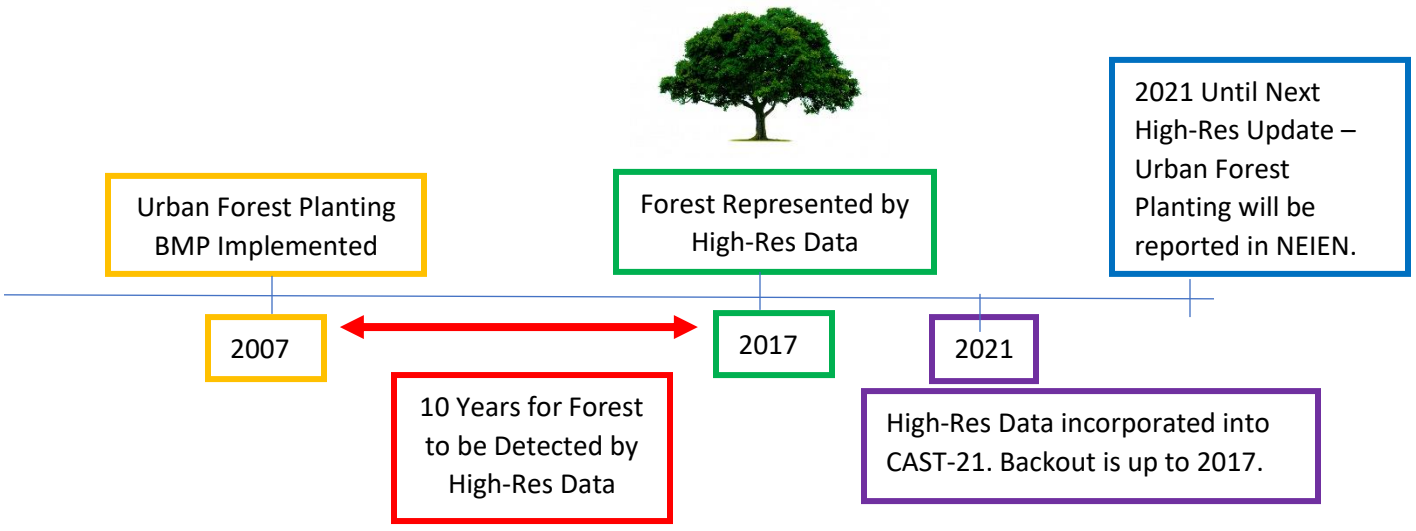
Backout For Tree Planting

Tree Planting is a land use change practice. Tree Planting practices are reported annually up until they are captured as the "Tree Canopy" land use. *With increased on the ground implementation of Tree Planting,* we would expect to see **an overall growth of the tree canopy** land use represented in the land cover data.



Backout For Urban Forest Planting

Tree Planting is a land use change practice. Tree Planting practices are reported annually up until they are captured as the "True Forest" land use. With increased on the ground implementation of Urban Forest Planting, we would expect to see an overall growth of the True Forest land use represented in the High-Res land cover data.



How Does Backout Effect Land Use Change BMPs that Receive an Efficiency?

The following land use change BMPs receive an efficiency:

- Grass buffers
- Grass buffer-streamside with exclusion fencing
- Forest buffers
- Forest buffer-streamside with exclusion fencing
- Wetland creation for floodplain and headwater
- Wetland restoration for floodplain and headwater

These practices reduce the amount of nutrients traveling through the soil or runoff from an upland area. If these practices are reported and verified up to the year of the land use/land cover imagery (the backout year), they will be included in the backout. Once included, they will no longer receive the land use change reduction, but will continue to receive their nutrient efficiency, or the upland credit. Once in the backout, these practices will be placed on land uses with lower loading rates. Please see ***"Backout for Forest Buffers"*** for an example of a land use change BMP with an efficiency.

What is Cutoff?

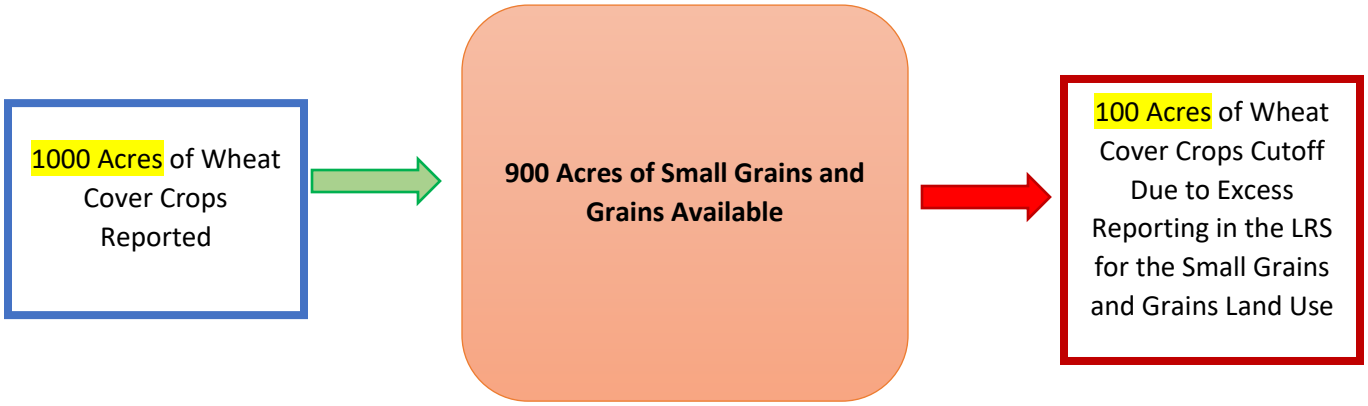
Cutoff, also known as "Excess", occurs when the acreage of a specific BMP reported within a given land river segment geography exceeds the amount of acreage available for that BMP to be placed on. New implementation BMP acres are broken down by load source and land river segment, then placed on the available land use acreage for that land river segment. If there is enough available acreage to accommodate the new implementation, then there will be no cutoff. If a BMP is reported at the state level and not assigned to a specific LRS/County geography, the acreage will be evenly distributed across all LRS geographies within the state.

For example, 1000 Acres of Cover Crops are reported within a land river segment [Ex. Wheat].

The 1000 acres of cover crops are broken down by load source and assigned to the applicable land use [Ex. Small Grains and Grains; all applicable load sources are found here.]

900 Acres of Small Grains and Grains are available within the land river segment.

900 Acres of Cover Crops are placed on the 900 available acres, while 100 acres of Cover Crops are cutoff.



Cutoff, or excess, can be observed for a given progress year by running a "Submitted vs Credited" Report in CAST. To be able to accomplish a true analysis of cutoff, it is important to look at the land river segment geography (BMPs are assigned to land uses at the land river segment scale).

How are Backout and Cutoff effected by Credit Duration?

Credit Duration is the amount of time a newly implemented or reverified BMP will remain in the model until it will need to be reverified.

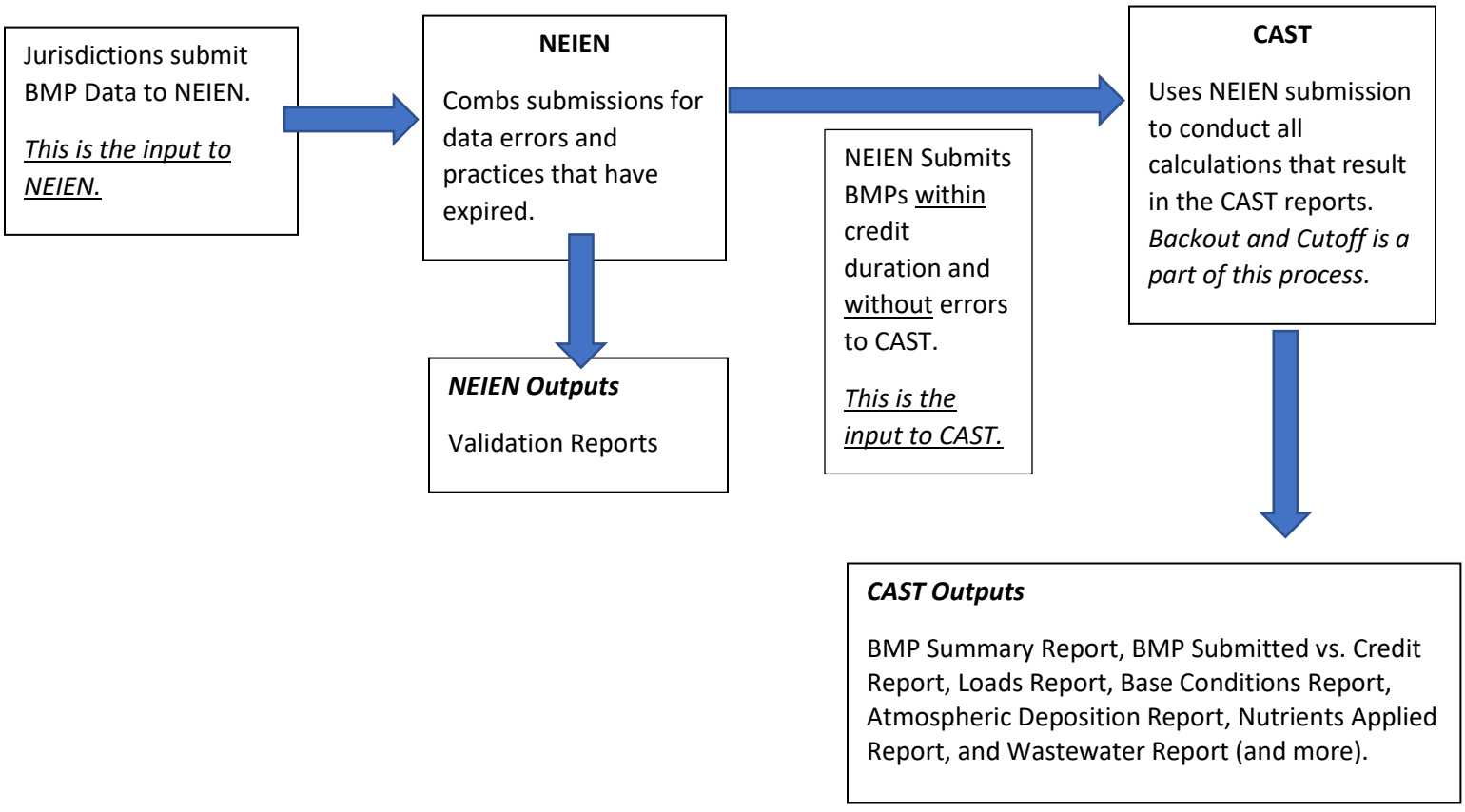
Each practice has an associated credit duration that were established with the Verification Framework Guidance. For example, the current credit duration of Forest Buffers is 10 years. After 10 years of being credited in the model, the Forest Buffers will need to be inspected and reverified to continue receiving reduction credit for another 10 years.

If the BMP is reverified, it will continue to receive credit in the model. If the BMP is not reverified, it will no longer be credited in the model and will expire from the model. The NEIEN Validation Reports indicate which reported BMPs were not submitted to CAST depending on credit duration/practice expiration or other data errors, which can be found through creating an account and logging into CAST.

So, how do they differ?

Credit Durations exist in NEIEN. Backout and Cutoff exist in CAST.

The outputs of NEIEN, observed in the validation reports, are submitted to CAST. CAST then uses the data outputs to produce the reports used to plan and evaluate annual progress. Backout and Cutoff are two of the many calculations that CAST is running through to produce its results.



What happens if you extend the credit duration of a practice?

By extending the credit duration of a practice, you are allowing more practices to enter CAST from NEIEN.

Greater Potential for Cutoff: This may lead to a greater potential for cutoff as there will be more practices to compete for available land use acreage in the model.

Backout is a separate component and will be calculated the same regardless of a credit duration extension. Backout incorporates only the practices that are verified and reported up to the year of the land use/land cover data. If credit duration and verification did not exist, it is likely more practices would be backed out in the model. The extension of credit duration changes the frequency of on the ground verification, therefore changing the frequency of which a jurisdiction would verify a practice and the process to report the practice.