IceTrendr - Polygon

A Landsat data visualization tool for monitoring glacier ecosystems

http://polygon.icetrendr.oregonstate.edu/

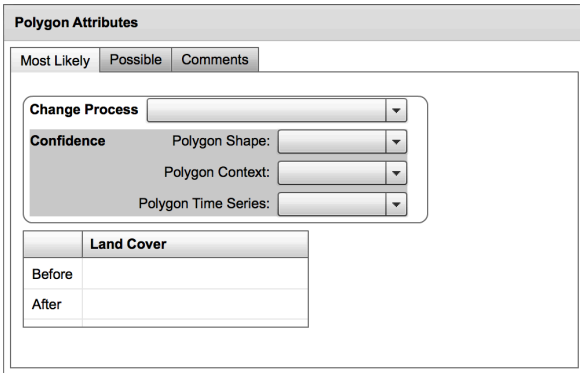
Polygon Attribution Instructions

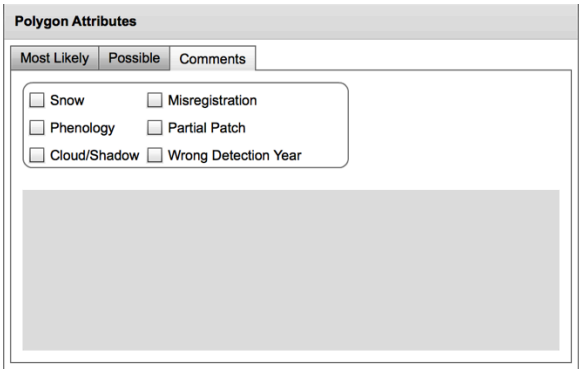
INTRODUCTION

We want to describe the process that caused a change on the landscape (in the entire area of the polygon outlined in red in the KML on Google Earth), and we want to record as much as possible about that change as you can understand from the context of the Landsat satellite imagery, high resolution imagery, and the Glacier Time Series graph. We want to know what was there before the change, after the change, how confidant you are in your call, and why. Be aware of the 'Change Year' value.

For each listed plot, the goal is to complete the data entry tabs of Most Likely, Possible, and Comments.

In most cases, you should only populate the "Most Likely" tab. However, if the change process is ambiguous and could equally be one of two things, use the "Possible" tab to enter the second process.





In particular, if the 'Change Year: 0' but you disagree, then mark 'Wrong Detection Year' and enter the change process year that the polygon references.

Supported by:
National Science
Foundation (1449784)

contact:
Peder Nelson (Peder.Nelson@oregonstate.edu)
Anne Nolin (anne.nolin@gmail.com)

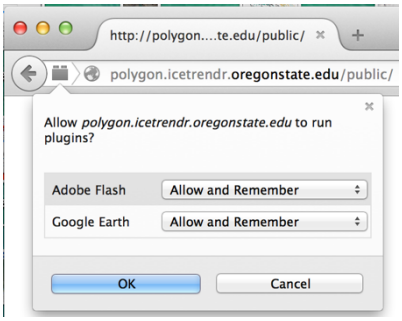
Polygon Attribution Instructions

OVERVIEW

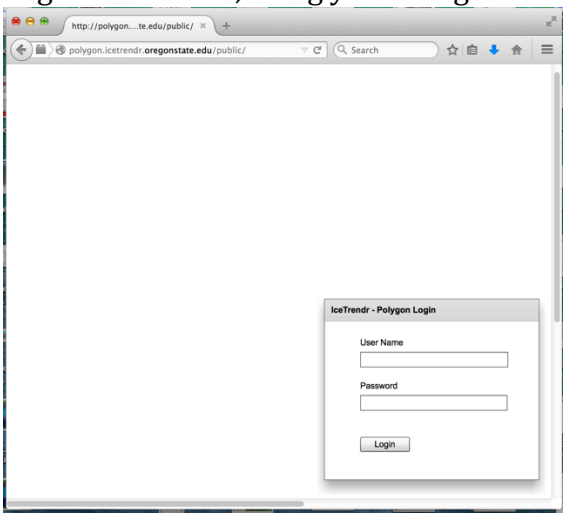
Prior to using IceTrendr, you will need to obtain a login and password by contacting Peder Nelson (peder.nelson@oregonstate.edu).

You may also use a guest login if you prefer but note that this profile is available to other users and therefore other users could overwrite any data:
Login: guest
Password: IsWelcome!

1. **In your browser, navigate to: http://polygon.icetrendr.oregonstate.edu/**
   At present, Firefox browser is the preferred browser because Chrome is now blocking the required Google Earth plug-in. Make sure you have the Google Earth plug-in added to your browser (https://www.google.com/earth/explore/products/plugin.html). Note you may need to 'allow' the plug-in when you first visit the website.



   a. Log in to website, using your assigned user name or 'guest'

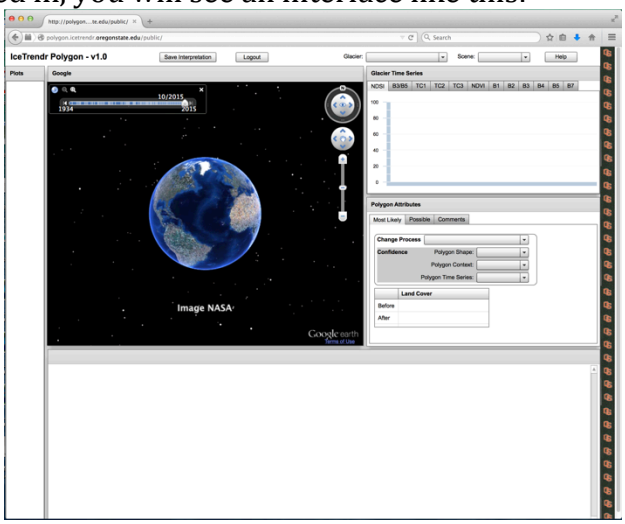


Supported by:
National Science Foundation (1449784)

contact:
Peder Nelson (Peder.Nelson@oregonstate.edu)
Anne Nolin (anne.nolin@gmail.com)

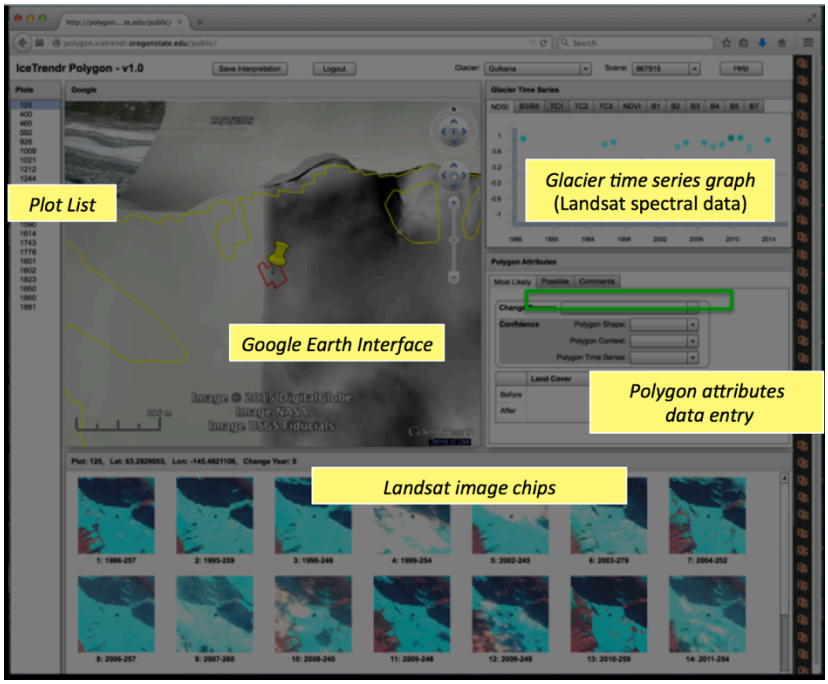
Polygon Attribution Instructions

2. Once logged in, you will see an interface like this:



IceTrendr-Polygon interface components

There are four main components to the label interface, which will be discussed in sequence: The ***Google Earth interface*** (center), the **Landsat image chips** (bottom), the **polygon attributes data entry** (center right), and the **glacier time series graph** (upper right).



Supported by:
National Science
Foundation (1449784)

contact:

Peder Nelson (Peder.Nelson@oregonstate.edu)

Anne Nolin (anne.nolin@gmail.com)

Polygon Attribution Instructions

Google Earth interface (center)

Key purpose is to assess the shape and context of the polygon relative to higher resolution imagery with the ability to navigate a virtual globe.

1. Here, you can see the polygon of interest overlaid on high spatial resolution satellite imagery or air photos.
2. Use the slider bar at the top to see historical imagery.
3. As with Google Earth, you can tilt, zoom, pan, etc. (see controls here).

Polygon attributes data entry (center right)

Key purpose is to guide interpretation and record attributes to a database

a. Using the drop-down menus, select from list of labels that describes the type of glacier changes observed in the image chips, Google Earth, and temporal trajectory.
b. Your selections are saved if you click on "Save Interpretation" or if you move on to a different plot.
c. Rules and guidance for assigning these labels on page 8.

Glacier time series graph (upper right)

Key purpose is to view the spectral data measured by the Landsat satellite. Using the location of the value on the y-axis and how that pixel moves along the x-axis is related to the land cover and the segment process. Since Landsat data is composed of 6 bands of information, use the different index values to create a multi-view understanding of how the polygon area graphs over time.

a. This shows the temporal trajectory of the center point of the patch. The center point is represented by the little square box in the chip windows (it is 3x3 Landsat pixels). This is done similar to aerial photography interpretation rules.
b. The spectral trajectory quantifies the story of the patch from Landsat's perspective. Different indices can be selected using the tabs (i.e. NDSI, Band3/5, TC1, TC2, TC3, etc.). These may tell slightly different stories.
c. If you need to zoom into a particular Y-value range, either right-click or select "plot stretch" or "global stretch" and use the mouse left-click and drag a box to define the new bounds of Y values.

Landsat image chips (bottom)

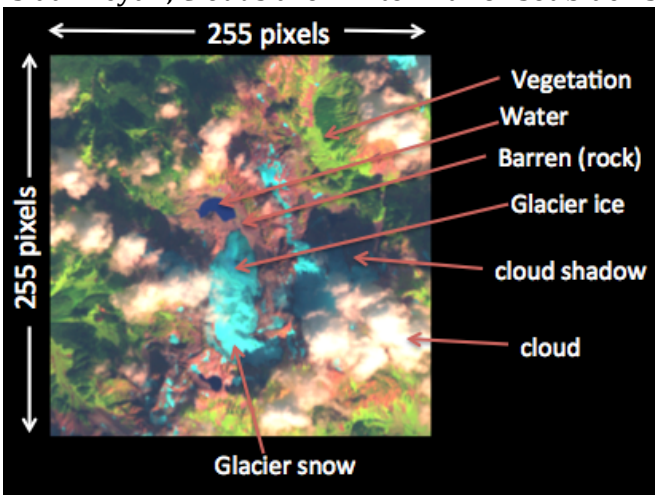
Key purpose is to view a zoomable series of 1984-2015 Landsat images for the polygon location. These images are false color combinations, which highlight glacier features while keeping many features similar to a natural color image. Note that the year where a change is claimed by the algorithm is noted just above the plot windows, in the upper left. We are only interested in describing what happened in that year.

Supported by:
National Science Foundation (1449784)

contact:
Peder Nelson (Peder.Nelson@oregonstate.edu)
Anne Nolin (anne.nolin@gmail.com)

Polygon Attribution Instructions

a. These are extractions of the Landsat data we have used in the automated segmentation.
b. Use the mouse wheel roller while hovering over an image chip to zoom in or out. (*note this only works on Windows OS)
c. The dates of the image are in the format YYYY-DDD, where DDD is the calendar day of year (starts with 1 on January 1st).
d. Color interpretation requires that you know how to interpret Landsat imagery in this false color band combination (red=band 5, green=band 4, blue=2).
e. As you zoom into the center of the image chip, you will need to use your understanding of color theory and your imagination to recognize true ecological changes that are visible in this view of the Landsat imagery because each pixel is 30m x 30m and comprised of multiple land cover types at certain resolutions.
f. The images are created to create false color images using Landsat bands 5, 4,2). Generally speaking: *Vegetation* is green, *Water* is blue, *Rock/soil* is red, *Glacier ice* is dark cyan, *Clouds* are white with offset black shadows, and *Snow* is bright cyan.



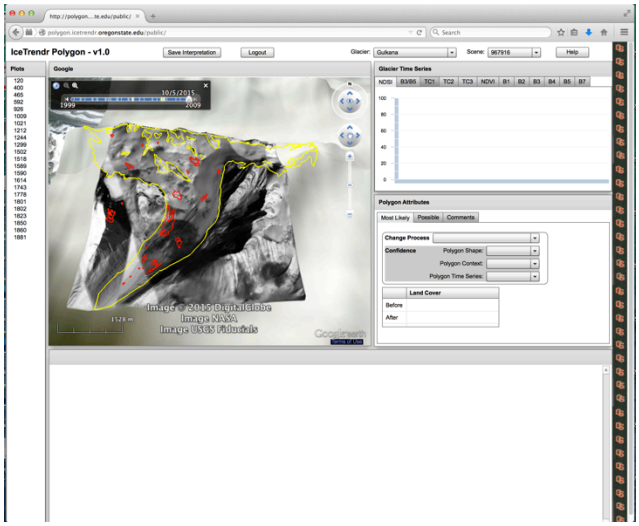
3. **Select the 'Project' you are working on, then select the 'Scene'.**
   a. Currently, we have five "projects" one for each glacier: South Cascade, Wolverine, Gulkana, White, and Bering.

   b. 'Scene' is the WRS2 Landsat path/row. It is in the format of a 6-digit number where the first three digits are the path number and the second three digits are the row number (eg '046026 = path 46, row 26)). Some glaciers span multiple path/rows, so we need to specify which one is the focus. Note, that if there is a leading '9' value in the path/row it denotes a glacier that consists of overlapping path or rows (eg '946926') which maximizes Landsat observations.

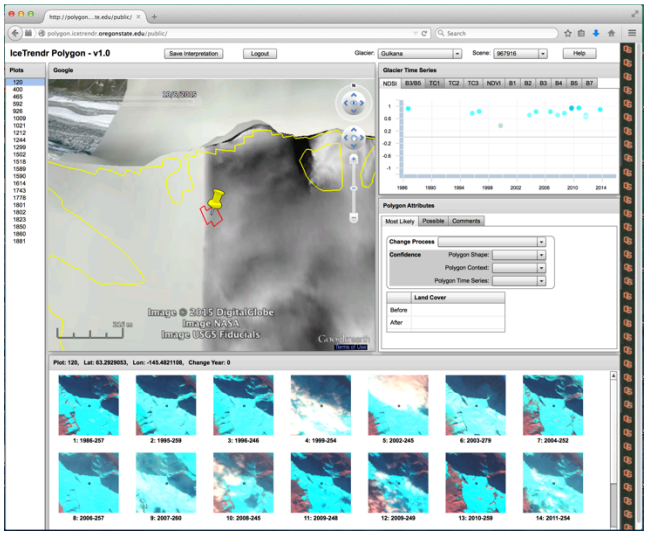
contact:
Peder Nelson (Peder.Nelson@oregonstate.edu)
Anne Nolin (anne.nolin@gmail.com)

Polygon Attribution Instructions

c. Once you have selected those values, the list of patches will populate the 'Plots' column. Each polygon has a red outline. Some of the patches share partial boundaries. The yellow line indicates the GLIMS glacier outline.



4. **Select a plot** by clicking with the mouse, and the interface will become populated. In the Google Earth interface you will notice a yellow pushpin that represents the location of the spectral trajectory within the patch.



contact:
Peder Nelson (Peder.Nelson@oregonstate.edu)
Anne Nolin (anne.nolin@gmail.com)

Polygon Attribution Instructions

5. **Begin interpretation as follows:**
   a. examine the Landsat image chips (zooming in & out for context)
   b. examine the polygon and neighborhood in Google Earth using the available high resolution and historical imagery

6. **Continue interpretation by entering data as follows:**
   c. Task: select the appropriate 'After: Land Cover'
   d. Task: select the appropriate 'Before: Land Cover'
   e. Task: select the appropriate 'Change Process' for the noted change year.
   f. Task: select the appropriate 'Confidence: Polygon Shape' for the patch
   g. Task: select the appropriate 'Confidence: Polygon Context' for the patch
   h. Task: select the appropriate 'Confidence: Polygon Time Series'

5. click 'Save Interpretation button'

Note as data is entered into the 'Polygon Attributes data entry' the plot number turns to *italics* noting that the values have changed but not yet saved to the database. After the button is pushed, if all data has been entered then the plot number is highlighted in green. If this does not occur, double-check all the data entry fields.

6. Select next plot in list, repeat interpretation process

Supported by:
National Science Foundation (1449784)

contact:
Peder Nelson (Peder.Nelson@oregonstate.edu)
Anne Nolin (anne.nolin@gmail.com)

Polygon Attribution Instructions

TASK 6C: IDENTIFY 'AFTER' LAND COVER USING DEFINED LIST

Your task is to identify the land cover type that dominates the polygon in the year of the **'Change Year:'** value located in the Landsat image chip block.
If the 'Change Year: 0' (i.e. there is no change), use the final image chip (2012-2015) for identifying 'After Land Cover'. Also if 'Change Year: 0', use the comments tab to note disagreements especially if the 'After' land cover does not match the 'Before' land cover.

In some cases, no single type covers more than 50% of the polygon (i.e. we're in a truly mixed setting), and in that case we check the "is dominant < 50%" button

A few general pointers: We make a call for the condition *immediately before and after the 'Change Year' noted in the chip window*. For more information on Land cover definitions, see the document at LandCover_IceTrendr_Polygon.pdf (http://polygon.icetrendr.oregonstate.edu/public/LandCover_IceTrendr_Polygon.pdf).

1. **Glacier** ice, bare ice
2. **Glacier** ice, firn
3. **Glacier** ice, snow-covered
4. **Glacier** ice, debris-covered
5. **Glacier** ice, crevassed
6. **Glacier** ice, other
7. **Iceberg**
8. **Snow**, seasonal snow
9. **Snow**, permanent snowfield
10. **Moraine**, terminal
11. **Moraine**, lateral
12. **Moraine**, medial
13. **Rock**, nunatak
14. **Rock**, horn
15. **Rock**, other
16. **Water**, supraglacial melt pond or lake
17. **Water**, supraglacier stream
18. **Water**, proglacial lake, high turbidity
19. **Water**, proglacial lake, low turbidity
20. **Water**, proglacial braided channels
21. **Water**, other
22. **Vegetation**, shrub
23. **Vegetation**, trees
24. **Vegetation**, other

Supported by:
National Science Foundation (1449784)

contact:
Peder Nelson (Peder.Nelson@oregonstate.edu)
Anne Nolin (anne.nolin@gmail.com)

Polygon Attribution Instructions

TASK 6D: IDENTIFY 'BEFORE' LAND COVER USING DEFINED LIST

Your next task is to identify the land cover type that dominates the polygon in the year preceding the 'Change Year'. Add other types if they are also present in the polygon. In some cases, no single type covers more than 50% of the polygon (i.e. we're in a truly mixed setting), and in that case we check the "is dominant < 50%" buttonIf the 'Change Year: 0' (i.e. there is no change), use the first good image chip (1984-1991) for identifying 'Before Land Cover'.

In some cases, no single type covers more than 50% of the polygon (i.e. we're in a truly mixed setting), and in that case we check the "is dominant < 50%" button

For more information on Land cover definitions, see the document at LandCover_IceTrendr_Polygon.pdf (http://polygon.icetrendr.oregonstate.edu/public/LandCover_IceTrendr_Polygon.pdf).

1. **Glacier** ice, bare ice
2. **Glacier** ice, firn
3. **Glacier** ice, snow-covered
4. **Glacier** ice, debris-covered
5. **Glacier** ice, crevassed
6. **Glacier** ice, other
7. **Iceberg**
8. **Snow**, seasonal snow
9. **Snow**, permanent snowfield
10. **Moraine**, terminal
11. **Moraine**, lateral
12. **Moraine**, medial
13. **Rock**, nunatak
14. **Rock**, horn
15. **Rock**, other
16. **Water**, supraglacial melt pond or lake
17. **Water**, supraglacier stream
18. **Water**, proglacial lake, high turbidity
19. **Water**, proglacial lake, low turbidity
20. **Water**, proglacial braided channels
21. **Water**, other
22. **Vegetation**, shrub
23. **Vegetation**, trees
24. **Vegetation**, other

Supported by: National Science Foundation (1449784)

contact:
Peder Nelson (Peder.Nelson@oregonstate.edu)
Anne Nolin (anne.nolin@gmail.com)

Polygon Attribution Instructions

TASK 6E. IDENTIFY 'CHANGE PROCESS'

We have already identified the land cover change on based on the 'Change Year'. The key strategy, in this step, is to capture the intent or the reason for the land cover change in the 'Before' and 'After' labels. If you are unsure of the reason for the land cover change, use both the 'Most Likely' and 'Possible' change processes. If you use the 'Other' category, describe your rationale in the comments block.

1. Stable

2. Glacier retreat
3. Glacier advance

4. Albedo increase
5. Albedo decrease

6. Debris flow

7. Water
8. Water - outburst flood
9. Water - fluvial changes
10. Water - supraglacial
11. Water – proglacial

12. Vegetation growth

13. Other

.

Supported by:
National Science Foundation (1449784)

contact:
Peder Nelson (Peder.Nelson@oregonstate.edu)
Anne Nolin (anne.nolin@gmail.com)

Polygon Attribution Instructions

IDENTIFY 'CHANGE PROCESS' CONFIDENCE

When determining what caused a change, there are three broad characteristics an interpreter uses: shape, context, and trajectory. For each, we want to know how much that characteristic helped you make the call about the change process, and how appropriate that characteristic is for the change process of interest.

6F. Polygon Shape: Based primarily on the historical imagery in the Google Earth interface.

- High confidence: You can interpret the historical imagery before and after the apparent change, and the shape of the polygon matches well with the changes caused by the process. Interpretation of the airphoto is key here: For example, a glacier retreat event would get a high score if you could see the glacier ice in imagery before the 'Change Year' and terminal moraine (rock) in imagery after the change.

- Medium confidence: You can interpret the historical imagery well only after or before the change, but the shape and the condition at that point in time are consistent with the segment process you claim.

- Low confidence: The historical imagery interpretation does not help assess the segment process, either because it's ambiguous, unavailable, or because the polygon's shape doesn't match with what's on the ground in the imagery.

6G. Polygon Context: Based on the historical imagery in the Google Earth interface, the Landsat image chips, and your knowledge of the landscape.

- High Confidence: The segment process is occurring in a part of the landscape where it is expected, and you can corroborate that by interpreting both the historical imagery in the Google Earth interface and the Landsat imagery. In some cases this will be the function of the surrounding area (say, an area that is glacier ice covered by rock debris surrounded by glacier ice) or by clearer indications of the change process occurring nearby (say, a plot appears to have low-level disturbance that could be topographic shadow or low-intensity albedo decrease, but by looking at the context in both Google Earth and the Landsat image chips, you see it was adjacent to a larger glacier retreat event in the same year that was more significant albedo decrease).

- Medium Confidence: The segment process is probably occurring in a place where it is expected, but your ability to assess is hampered by either difficulty interpreting the surrounding area, or by lack of knowledge of the segment process within that landscape.

- Low Confidence: The segment process seems inappropriate to the surrounding area, or simply is uninformative. It's possible to be confident about a segment process, but not to rely on the context at all for making the call – in this case, select "low confidence".

Supported by: National Science Foundation (1449784)

contact:
Peder Nelson (Peder.Nelson@oregonstate.edu)
Anne Nolin (anne.nolin@gmail.com)

Polygon Attribution Instructions

6H. Polygon Time Series: Based primarily on the Glacier time series graph, but also to some extent on the Landsat image chip time series.

- High confidence: The graph (spectral trajectory) is unambiguous and is completely consistent before and after the change with the kind of segment process being claimed.

- Medium confidence: The time series graph is consistent, but only captures part of the story (say, it occurs right at the end of the time period, so you can't be sure of the polygon label). Or, the time series graph is possibly consistent with the segment process, but could also be consistent with a different segment process (Moraine, terminal vs Water, proglacial braided channels).

- Low confidence: The time series graph does not aid at all in making the call. This could mean that the point used to derive the trajectory (the center of the polygon) is not representative of the whole polygon, or that there is no signal in the time series graph at the right time of the claimed change noted in the 'Change Year'.

.

contact:
Peder Nelson (Peder.Nelson@oregonstate.edu)
Anne Nolin (anne.nolin@gmail.com)