How Deep Do We Dig Here?

A Methodological Note on Regional Net-Burial Modeling, Surface Survival, and Subsurface Archaeological Prospecting

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Methodological Note, Version 0.1

Abstract

How Deep Do We Dig Here? is a regional archaeological prospecting instrument designed to extend the global overburden logic of **How Deep Do We Dig?** into region-specific planning. While Tool 1 models generalized accumulation across broad environmental regimes, Tool 2 introduces regional correction factors: erosion, deflation, truncation, compaction, bioturbation, pedogenesis, hydrology, preservation potential, disturbance, and geophysical suitability. The purpose is not to predict exact site depth. Rather, the tool provides a structured way to estimate a regional **depth-to-potential cultural surface**, evaluate the likelihood of surface survival or burial, and suggest appropriate field methods such as pedestrian survey, shovel testing, augering, coring, trenching, excavation, or geophysical prospection.

The tool begins with a spinning globe. When a region is selected, the globe rotates toward the selected area and transitions into a regional analytical map. This interface is designed to make scale explicit: global accumulation is only the starting point, while regional burial and exposure require local geomorphological reasoning. The result is a planning framework for archaeologists, geoarchaeologists, students, remote-sensing teams, GPR teams, and interdisciplinary researchers who need to ask not only how deep material may be buried, but whether the surface has survived, whether it has been truncated, and which method is appropriate for detecting it.

1. Introduction: From Global Overburden to Regional Burial

Tool 1, **How Deep Do We Dig?**, was created to provide a generalized global view of overburden accumulation through time. It helps users develop broad depth intuition by showing how atmospheric dust, volcanic ash, alluvial deposition, colluvial slopewash, coastal sedimentation, glacial/periglacial sediment, organic accumulation, anthropogenic fill, and regolith development can blanket archaeological surfaces over long temporal windows.

Tool 2, **How Deep Do We Dig Here?**, moves from global accumulation to regional net-burial reasoning. This shift is necessary because archaeological depth is not only a question of how much material has accumulated. It is also a question of what has been removed, compressed, disturbed, transformed, preserved, or rendered invisible.

A cultural surface may be deeply buried in an alluvial basin, erased by erosion on an exposed upland, compacted in a floodplain, vertically mixed by bioturbation, masked by urban fill, preserved beneath peat, or made difficult to detect by clay-rich soils that reduce geophysical visibility. Tool 2 is therefore a regional correction instrument. It begins with gross accumulation, then modifies that estimate through process factors that affect net burial, surface survival, and method suitability.

2. Purpose of the Tool

The purpose of Tool 2 is to help answer the question:

How deep do we dig here?

This question includes several related planning problems:

How deeply might a potential cultural surface be buried in this region?
Has the surface likely accumulated overburden or experienced erosion?
Is surface survey likely to detect the target, or is the surface probably invisible?
Should the field team consider augering, coring, trenching, shovel testing, excavation, or remote sensing?
Is GPR likely to perform well in the selected regional conditions?
What are the main uncertainty factors before fieldwork begins?

Tool 2 should not be treated as a final predictive model. It is a regional planning and hypothesis-generation instrument. Its goal is to improve archaeological depth reasoning before field methods are selected.

3. Intended Audience

The intended audience includes:

Field archaeologists
Academic archaeologists
Geoarchaeologists
Students
Remote-sensing teams
GPR teams
CRM and compliance researchers
Interdisciplinary researchers
Researchers developing survey or excavation strategies
Educators teaching geoarchaeology, stratigraphy, and site formation

The tool is especially useful when a team needs to decide whether surface survey is sufficient or whether a buried landscape model is required before fieldwork proceeds.

4. Relationship to Tool 1

Tool 1 and Tool 2 have different methodological roles.

Tool 1: How Deep Do We Dig?

Tool 1 is a global accumulation visualizer. It provides a broad heuristic estimate of how matter may accumulate over time across generalized environmental regimes. It is useful for teaching, orientation, and early planning.

Tool 2: How Deep Do We Dig Here?

Tool 2 is a regional burial and surface-survival visualizer. It introduces local correction factors and method suitability. It is designed to move from generalized accumulation toward field-relevant planning.

The relationship can be summarized as:

Tool 1 estimates generalized accumulation. Tool 2 estimates regional field relevance.

5. Core Methodological Concepts

5.1 Gross Accumulation

Gross accumulation is the total amount of material that may have been deposited over a selected time period before considering removal, compaction, mixing, or disturbance.

Examples include atmospheric dust, volcanic ash, alluvium, colluvium, organic accumulation, coastal sediment, glacial sediment, and anthropogenic fill.

5.2 Net Burial

Net burial is the remaining material above a cultural surface after accumulation has been modified by erosion, deflation, truncation, compaction, bioturbation, pedogenesis, hydrology, and disturbance.

Tool 2's key methodological move is the transition from gross accumulation to net burial.

5.3 Surface Survival

Surface survival refers to whether a past cultural surface remains physically present, partially preserved, deeply buried, mixed, truncated, or destroyed.

This is different from depth. A deeply buried surface may survive well. A shallow surface may be heavily disturbed or eroded.

5.4 Surface Invisibility

Surface invisibility occurs when a cultural surface is present but unlikely to be detected by surface survey because accumulated material, vegetation, later occupation, sedimentation, or surface transformation masks it.

Tool 2 should help distinguish between:

surface absence
surface invisibility
surface disturbance
surface truncation
surface burial
surface preservation

5.5 Depth Granularity

Depth granularity is the vertical resolution needed to choose a field method. It asks how fine-grained the team's depth expectation must be before choosing among surface survey, shovel testing, augering, coring, trenching, excavation, GPR, magnetometry, electrical resistance, or other remote-sensing approaches.

6. Regional Selection Logic

Tool 2 begins with a dropdown menu of regions. The globe spins in place until a selection is made. Once a region is selected, the globe rotates toward the selected region and transitions into a regional analytical map.

This visual sequence is methodologically important. It shows that the user is moving from a global model to a regional model. The transition makes scale visible.

Initial regions may include:

North American Southwest / Basin and Range
Great Basin / Intermountain West
Mesoamerican Highlands and Lowlands
Andean Pacific Coast
Mesopotamian Alluvial Plain
Nile Valley and Delta
Sahara / Sahel Transition
European Loess Belt

Levant Corridor
East African Rift
Amazon Basin
Siberian Periglacial Zone
Sunda-Sahul / Island Southeast Asia
Pacific Northwest Volcanic and Coastal

Each region should carry different default weights for deposition, erosion, preservation, hydrology, and GPR suitability.

7. Regional Correction Factors

Tool 2 includes the following correction factors.

7.1 Erosion and Deflation

Erosion removes material from the surface or near-surface environment. Deflation removes fine sediment, often leaving lag deposits, desert pavements, exposed artifacts, or mixed surface contexts.

In Tool 2, erosion should reduce the net-burial estimate and lower surface-survival confidence when truncation is likely.

7.2 Truncation and Disturbance

Truncation refers to the removal or cutting of stratigraphy by natural or human processes. Disturbance includes plowing, construction, road grading, terracing, looting, animal activity, root action, and other modifications that alter context.

Tool 2 should treat truncation as a major warning factor because it can erase the very surface the researcher is trying to locate.

7.3 Compaction

Compaction reduces the thickness of sediment after deposition. Over long timeframes, loose sediment can compress, especially in alluvial, organic, or saturated environments.

Tool 2 should include compaction as a correction to gross accumulation. It should not imply exact precision, but it should indicate that original deposited thickness and present burial thickness may differ.

7.4 Bioturbation and Vertical Mixing

Bioturbation includes the vertical movement of sediment and artifacts by roots, burrowing animals, insects, worms, and other biological processes. It can blur stratigraphy, move artifacts vertically, and complicate depth interpretation.

Tool 2 should treat bioturbation as a confidence modifier rather than a direct depth predictor unless regional calibration data are available.

7.5 Pedogenesis and Regolith Alteration

Pedogenesis transforms surface materials into soil horizons. It alters color, texture, chemistry, structure, organic content, and stratigraphic visibility. Regolith development similarly modifies the near-surface environment through weathering.

Tool 2 should treat pedogenesis as both a preservation factor and a visibility factor.

7.6 Hydrology and Preservation

Hydrology strongly affects archaeological preservation and geophysical visibility. Saturated, anoxic, peat-rich, or wetland environments may preserve organic remains, while high-energy flood settings may erode, rework, or bury deposits rapidly.

Hydrology also affects GPR performance, especially through moisture content, conductivity, and dielectric contrast.

7.7 Local Sedimentation Rate

Local sedimentation rate should be included as a regional parameter when available. In the absence of precise local data, Tool 2 should use broad regional presets and label the output as heuristic.

7.8 Anthropogenic Modification

Urban, agricultural, and construction contexts can produce rapid burial, truncation, and reworking. Anthropogenic fill may bury older surfaces, but it can also destroy or displace them.

Tool 2 should treat anthropogenic modification as both an accumulation factor and a disturbance factor.

8. GPR Suitability

Tool 2 includes GPR suitability because regional burial depth alone is not enough to choose a geophysical method. GPR performance depends on several variables:

Soil moisture
Clay and silt content
Salinity
Electrical conductivity
Antenna frequency
Target size
Target contrast
Depth of target
Surface roughness
Stratigraphic heterogeneity
Rockiness or gravel content

GPR generally performs better in dry, resistive, relatively homogeneous sediments and worse in highly conductive, clay-rich, saline, saturated, or heterogeneous contexts. The tool should therefore provide a suitability estimate rather than a promise of detection.

Suggested GPR output categories:

High suitability
Moderate suitability
Low suitability
Poor suitability
Not recommended without local testing

The GPR panel should also include a caution that local test transects and calibration are required.

9. Suggested Method Stack

Tool 2 should output a suggested method stack. This is not a command to excavate. It is a planning recommendation based on regional conditions.

Possible method recommendations include:

Pedestrian survey
Surface collection
Shovel test pits
Augering
Coring
Geoarchaeological trenching
Controlled excavation

GPR
Magnetometry
Electrical resistance
Electromagnetic conductivity
Drone photogrammetry
LiDAR
Sediment sampling
Micromorphology
OSL or radiocarbon sampling where appropriate

The method stack should change depending on net-burial estimate, surface-survival confidence, GPR suitability, and disturbance risk.

10. Interface Logic

The visualizer should include:

Region dropdown
Idle spinning globe before selection
Animated rotation to selected region
Zoom transition into regional map
Detailed coastline and landform mask
Regional heatmap
Layer toggles
Stacked or solo-layer mode
Temporal slider
Editable year field
Gross accumulation estimate
Net burial estimate
Erosion correction
Truncation/disturbance correction
Compaction correction
Bioturbation confidence modifier
Pedogenesis/regolith modifier
Hydrology/preservation modifier
GPR suitability panel
Suggested method stack
Surface survival panel
Surface invisibility panel
Community annotation section
Methodological PDF section

The interface should feel like a scientific planning instrument. The region map should be visually restrained, with fine heatmap rendering, detailed coastlines, and clear legends.

11. Regional Output Logic

For each selected region, the tool should produce:

A gross accumulation range
A net-burial-adjusted range
A recommended starting-depth band
A surface-survival assessment
A surface-invisibility assessment
A GPR suitability score
A preservation confidence statement
A method stack
A list of dominant regional processes
A list of uncertainty factors

The tool should avoid over-precise numbers. Range bands are preferable to single-point estimates.

Suggested output units:

centimeters
meters
range bands
method-relevant depth categories

Examples of range bands:

0–25 cm
25–50 cm
50 cm–1 m
1–2 m
2–5 m
5–10 m
10+ m

12. Surface Survival Categories

Tool 2 should classify surface survival using categories such as:

Likely exposed
Likely shallowly buried
Likely buried but intact
Likely buried and mixed
Likely truncated
Likely reworked

Likely deeply buried
Unknown without coring or excavation

These categories help prevent the tool from reducing archaeology to depth alone.

13. Surface Invisibility Categories

Suggested categories:

Surface-visible likely
Surface visibility uncertain
Surface invisibility possible
Surface invisibility likely
Surface survey insufficient
Subsurface testing recommended

This panel is important because many archaeological surfaces may not be visible from the ground surface even if they are preserved.

14. Workflow for Use

1. Select a region.
2. Allow the globe to rotate and transition into the regional map.
3. Choose the target age window.
4. Review regional environmental assumptions.
5. Activate or deactivate relevant process layers.
6. Compare gross accumulation and net burial.
7. Review surface survival.
8. Review surface invisibility.
9. Review GPR suitability.
10. Review suggested method stack.
11. Record the assumptions and output ranges.
12. Compare the tool output with existing geological, archaeological, and remote-sensing data.
13. Refine with field observations, coring, trenching, or regional datasets.
14. Submit methodological comments or regional correction notes.

15. Example Use Scenario: Mesopotamian Alluvial Plain

A researcher selects the Mesopotamian Alluvial Plain and enters a target window of 10,000 years. The tool assigns strong weights to alluvial deposition, floodplain burial, anthropogenic modification, and compaction. It may indicate that surface survey alone could miss older surfaces beneath later alluvium and occupation debris. The method stack may suggest remote-

sensing review, coring, geoarchaeological trenching, and cautious use of GPR depending on sediment moisture, salinity, and clay content.

The output would not claim that a particular site lies at a precise depth. It would indicate that regional burial processes make subsurface planning necessary.

16. Example Use Scenario: European Loess Belt

A researcher selects the European Loess Belt and enters a Pleistocene target window. The tool increases aeolian/loess weighting and may indicate that older surfaces could be buried beneath fine windblown sediment. Surface invisibility may increase with time depth. Suggested methods may include survey of exposures, coring, sediment profiling, micromorphology, and dating strategies tied to stratigraphic position.

17. Example Use Scenario: North American Southwest / Basin and Range

A researcher selects the North American Southwest and evaluates a late Pleistocene or early Holocene window. The tool may show a mixed landscape: some surfaces are exposed or deflated, while others are buried in alluvial fans, playas, dunes, or basin fills. Because Tool 2 includes regional correction factors, it can show why the same broad region may require both surface survey and subsurface testing depending on landform context.

18. Example Use Scenario: Pacific Northwest Volcanic and Coastal

A researcher selects the Pacific Northwest Volcanic and Coastal region. The tool increases volcanic ash, colluvial, coastal, and hydrological factors. It may indicate that some cultural surfaces could be buried beneath tephra, slopewash, or coastal sediment, while other areas may be disturbed by erosion or shoreline change. GPR suitability may vary strongly by moisture, sediment type, and local conductivity.

19. Community Annotation

The comment section should be framed as a regional methodological annotation log. It should invite:

Regional correction suggestions
Field observations
Local sedimentation-rate references
Known erosion or truncation cases
GPR performance notes
Case-study suggestions
Citation leads

Tool calibration feedback
Suggested regions
Suggested process layers
Known false positives or false negatives
Excavation-depth comparisons
Remote-sensing comparisons

The annotation system should support cumulative refinement. Users are not merely commenting on the page; they are helping improve the regional model.

20. Limits of Tool 2

Tool 2 is more specific than Tool 1, but it remains a planning instrument. It does not replace:

field survey
local geological mapping
soil descriptions
sediment cores
excavation
stratigraphic profiles
radiocarbon or OSL dating
geophysical test grids
professional geoarchaeological judgment

The model should be interpreted as a regional first-pass planning framework. Its value lies in making assumptions visible and helping teams choose better methods before committing field resources.

21. Future Development

Future versions should add:

coordinate-based selection
regional GIS layers
DEM integration
soil maps
river-basin boundaries
volcanic hazard and tephra datasets
loess distribution layers
glacial/periglacial maps
coastal paleoshoreline models
local sedimentation-rate libraries
GPR antenna-frequency planning
soil conductivity presets
field-uploaded calibration data

case-study archive
exportable field-planning report
citation-linked regional presets

22. Conclusion

How Deep Do We Dig Here? extends the global accumulation logic of Tool 1 into regional archaeological prospecting. It recognizes that the question of depth is not only about accumulation, but also about survival, erosion, disturbance, compaction, hydrology, soil formation, bioturbation, and method suitability.

The tool's central contribution is methodological clarity. It makes regional assumptions visible, separates gross accumulation from net burial, distinguishes surface invisibility from archaeological absence, and helps field teams choose a more appropriate depth strategy.

Its guiding question is practical but profound:

How deep do we dig here, and how do we know that depth is archaeologically meaningful?

Appendix A: Preliminary Reference Categories

Geoarchaeology and site formation
Behavioral archaeology and formation processes
Archaeological stratigraphy
Pedogenesis and soil morphology
Alluvial deposition and floodplain archaeology
Aeolian dust and loess
Tephrochronology and volcanic ash stratigraphy
Colluvial slopewash and hillslope processes
Coastal geomorphology and shoreline change
Wetland archaeology and peat preservation
Urban archaeology and anthropogenic fill
Bioturbation and vertical artifact movement
Geophysical prospection in archaeology
Ground-penetrating radar in archaeology
Soil conductivity, clay, moisture, and GPR limitations
Remote-sensing method selection
Regional GIS and DEM-based archaeological modeling
Case studies in buried landscapes